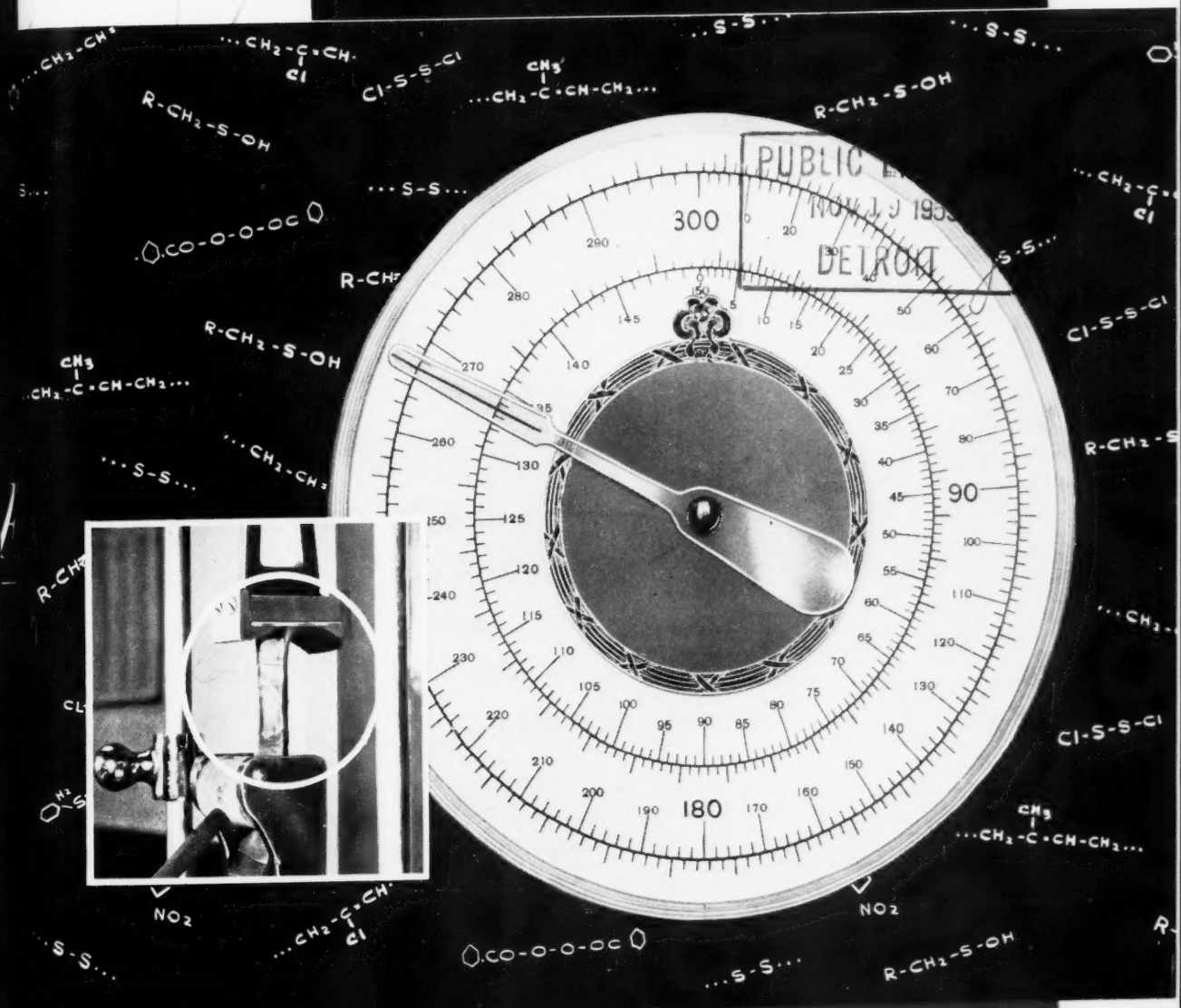
...CHNOLOGY DEPT.

...VEMBER, 1955

RUBBER WORLD

NOW IN ITS 67th YEAR



SOME FUNDAMENTAL ASPECTS OF RUBBER-METAL ADHESION

By D. M. Alstadt, page 221

Contents, page 219

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...BLICATION

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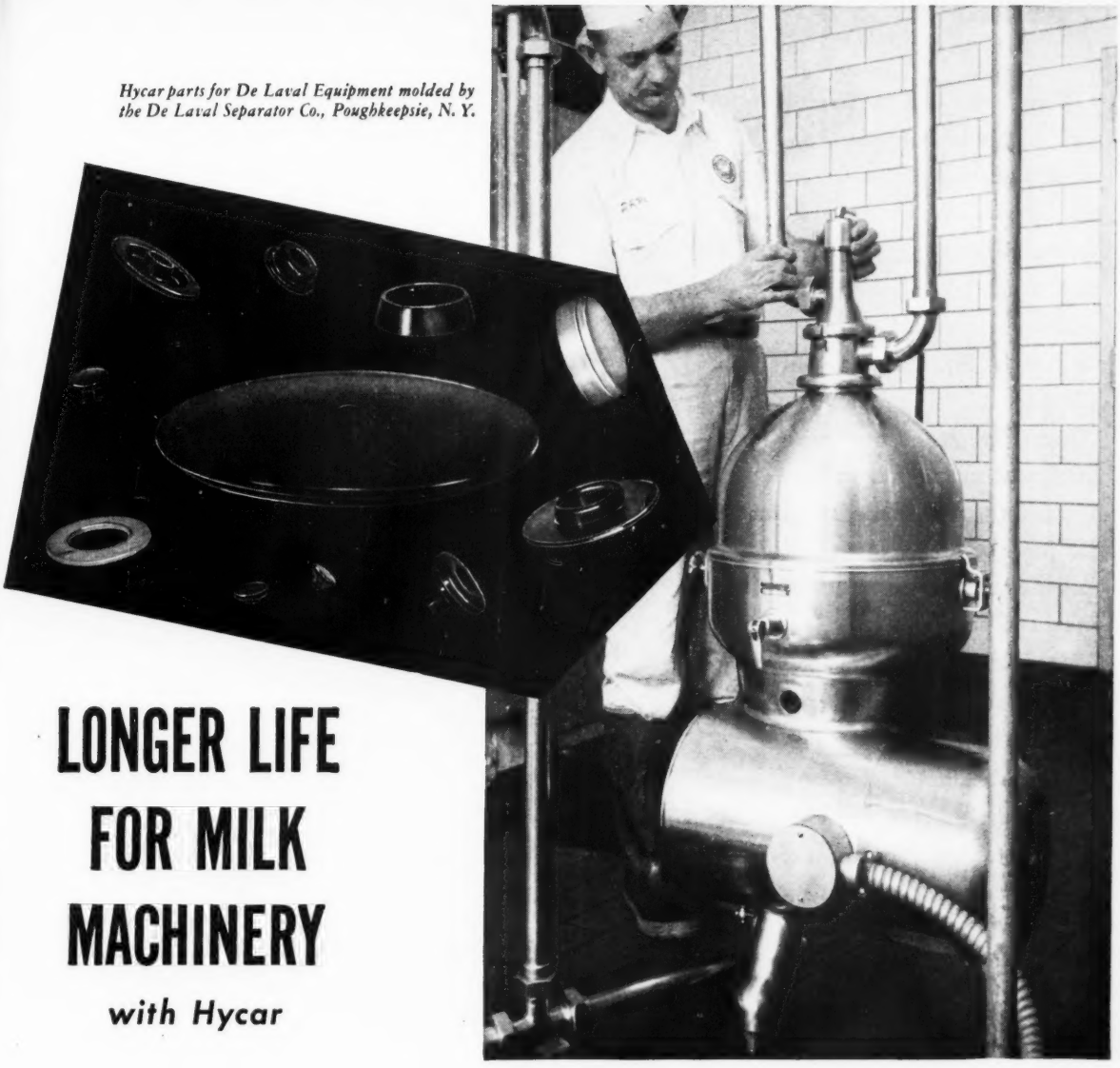

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CUTTING costs in milk production is good business for everybody. On dairy machines like milkers, separators, and coolers, the unique properties of Hycar American rubber help keep maintenance and replacement costs at a minimum.

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On farms, in oil-fields, and factories in almost every branch of industry, products and parts made from Hycar last longer, do many jobs better. Versatile Hycar can be molded, extruded, shaped to precise dimensions, and is readily blended with other materials to obtain special characteristics. For the complete Hycar story, please write Department CL-11, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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We've tested tires on the road and in the laboratory. We've timed the rate of growth of cuts and cracks. We've measured the treads to a thousandth of an inch to find the abrasion rate. And we've compiled important data on flex life, aging, and tensile strength.

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The valuable knowledge we've gained from years of experience in this field is available to rubber manufacturers. If you have a particular problem our Phil black research department may have the answer. If not, we'll try to get it for you, without obligation. For more information consult your Philblack technical representative.

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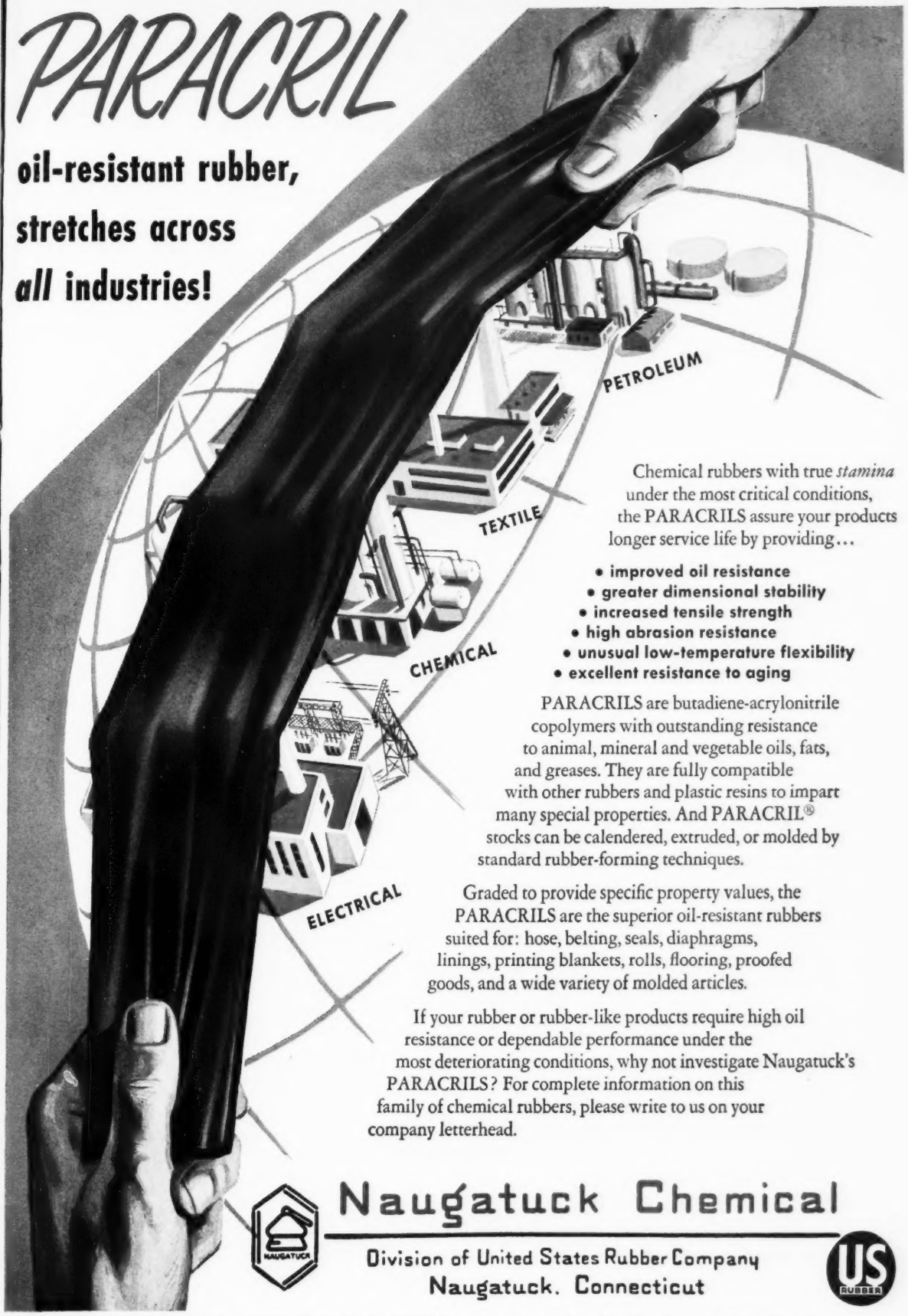
oil-resistant rubber, stretches across *all* industries!



Chemical rubbers with true *stamina* under the most critical conditions, the PARACRILS assure your products longer service life by providing...

- **improved oil resistance**
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- **high abrasion resistance**
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PARACRILS are butadiene-acrylonitrile copolymers with outstanding resistance to animal, mineral and vegetable oils, fats, and greases. They are fully compatible with other rubbers and plastic resins to impart many special properties. And PARACRIL® stocks can be calendered, extruded, or molded by standard rubber-forming techniques.

Graded to provide specific property values, the PARACRILS are the superior oil-resistant rubbers suited for: hose, belting, seals, diaphragms, linings, printing blankets, rolls, flooring, proofed goods, and a wide variety of molded articles.

If your rubber or rubber-like products require high oil resistance or dependable performance under the most deteriorating conditions, why not investigate Naugatuck's PARACRILS? For complete information on this family of chemical rubbers, please write to us on your company letterhead.

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A NEW TREND UNDERFOOT

—and the key is CHEMIGUM

Here's something new for shoe soles or any other rubber product where oil resistance may be needed. It's a series of stocks based on blends of CHEMIGUM and PLIOFLEX.

CHEMIGUM is the easy processing nitrile—first and finest of its type in the field. PLIOFLEX is a styrene rubber of the highest quality. Both have been used individually in high-grade shoe soles of various types.

Now, these outstanding rubbers have been blended to provide sole stocks which are better in combined oil-resistance and general performance properties than those provided by other types of rubber or blends (see photos and table). Other distinct advantages are a low specific gravity for a lighter weight sole at a very attractive pound-volume cost and excellent low temperature properties.

Moreover, you'll find these CHEMIGUM/PLIOFLEX blends are easy to process. They exhibit excellent bin aging properties, safe scorch values and can be mixed in the same manner as straight styrene rubber stocks. That's because CHEMIGUM, like PLIOFLEX, tends to soften under mastication.

Why not learn more about high-quality, low-cost CHEMIGUM/PLIOFLEX blends for shoe soles, hose, belting, molded goods or any rubber products exposed to oil? Samples and technical help are yours by writing to:

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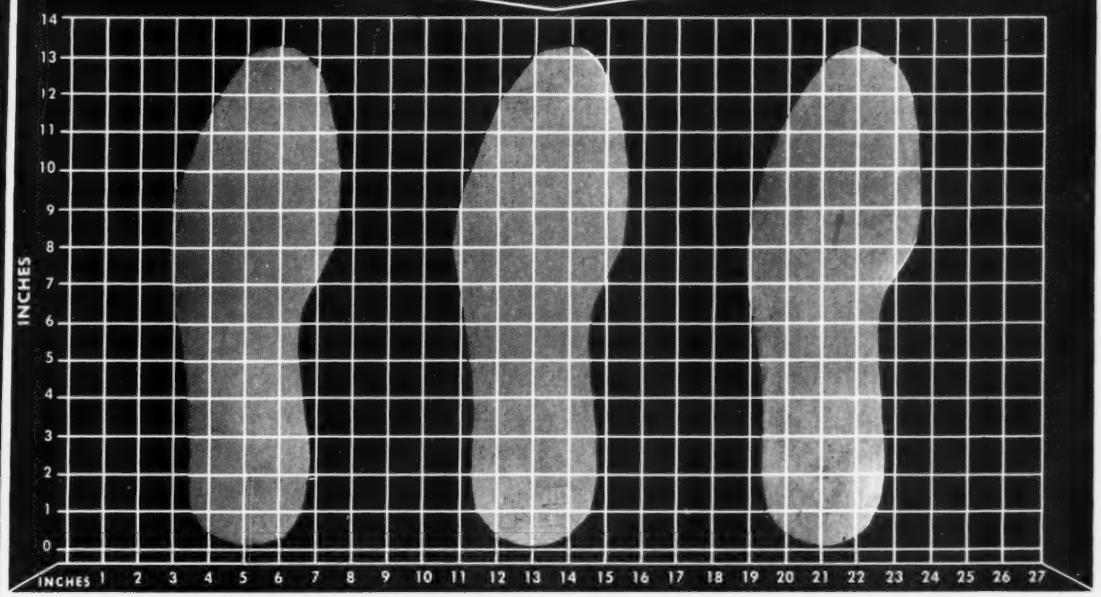
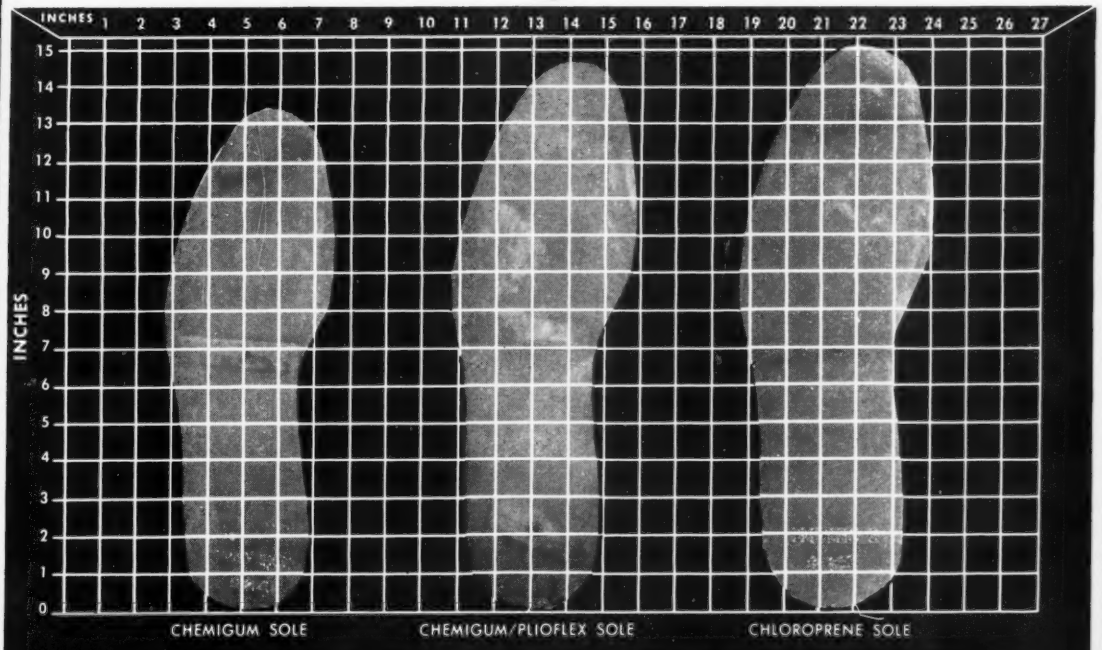
ORIGINAL SOLES



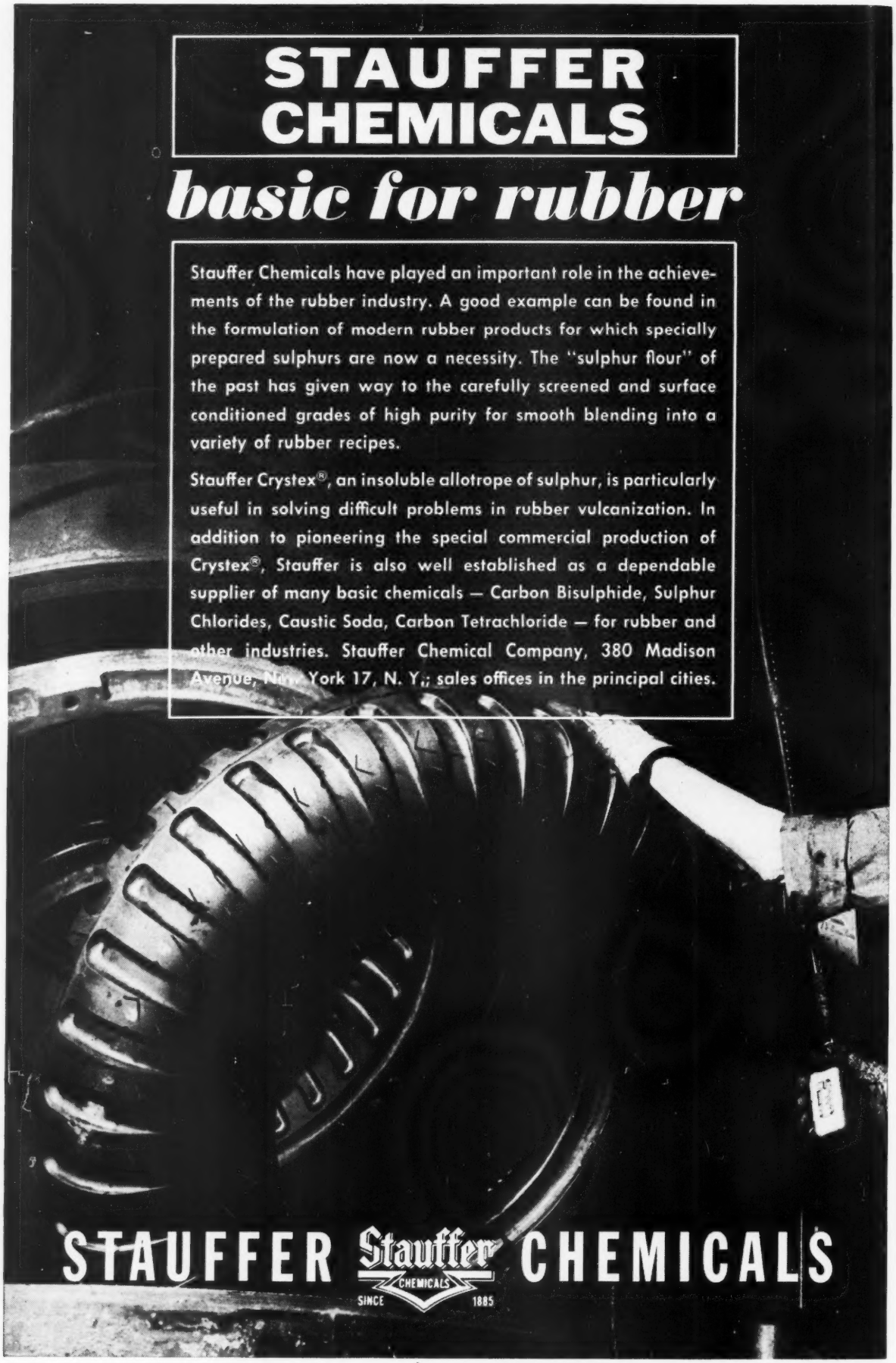
SOLES AFTER IMMERSION IN ASTM OIL #3 FOR 70 HOURS AT R. T.



PHYSICAL PROPERTIES OF CHEMIGUM and CHEMIGUM/PLIOFLEX SOLE vs. CHLOROPRENE SOLE

	HARDNESS (SHORE A)	CRESCENT TEAR, LBS./IN.	ROSS FLEX (12 IRON SOLE AGED 24 HRS. @ 212°F.— ASTM #1 OIL ADDED TO CUT)	ABRASION RESISTANCE (BUREAU OF STANDARDS)	VOLUME SWELL, % INCREASE (AGED 70 HRS. IN ASTM #3 OIL @ 158°F.)	SPECIFIC GRAVITY	COST/LB. VOL.
CHEMIGUM SOLE*	86	521	43,238	90.7	3.66	1.305	41.3¢
CHEMIGUM/PLIOFLEX SOLE*	83	288	87,285	53.8	44.4	1.208	36.3¢
CHLOROPRENE SOLE*	90	416	47,008	56.6	71.2	1.42	40.7¢

*Formulations available on request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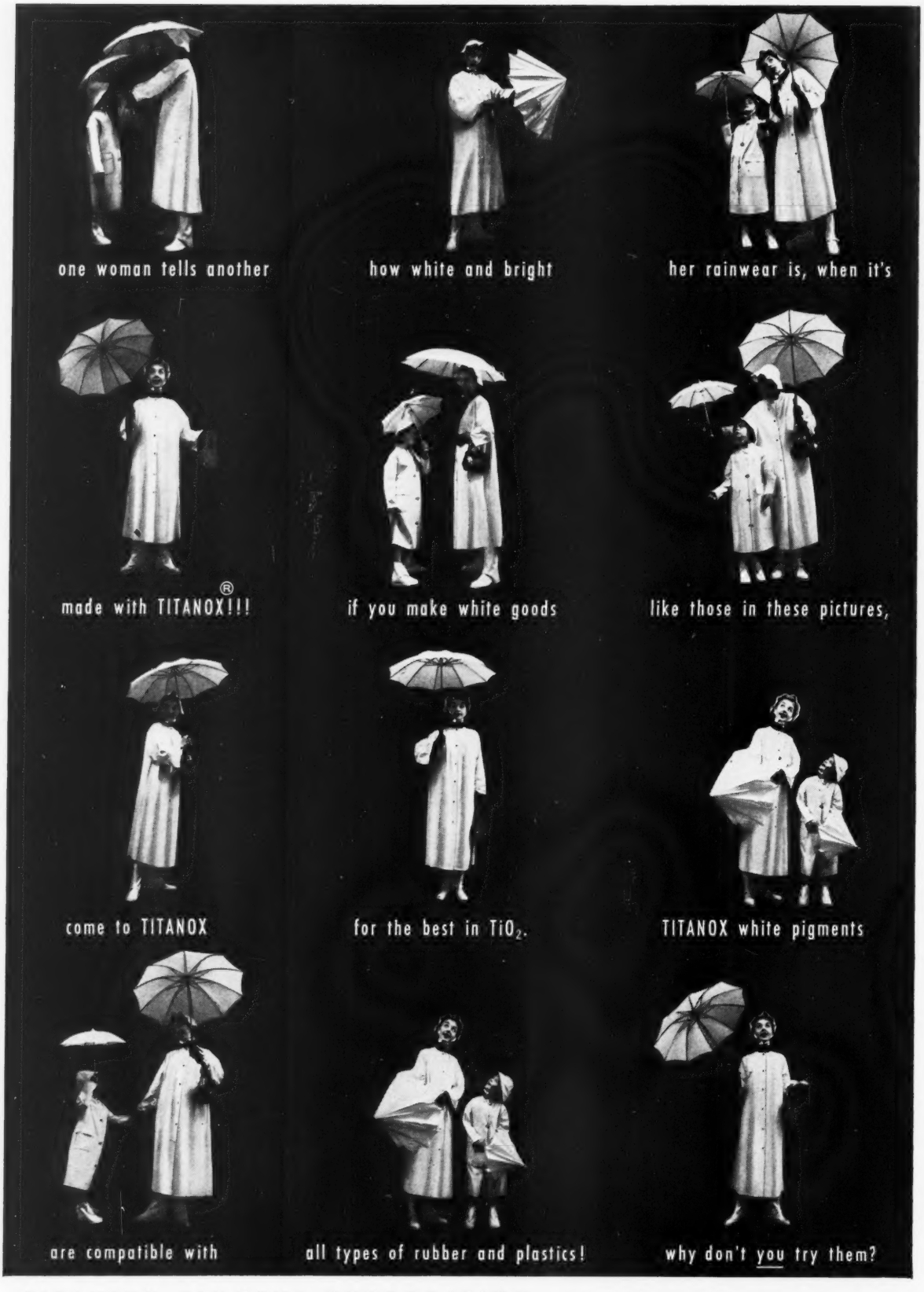
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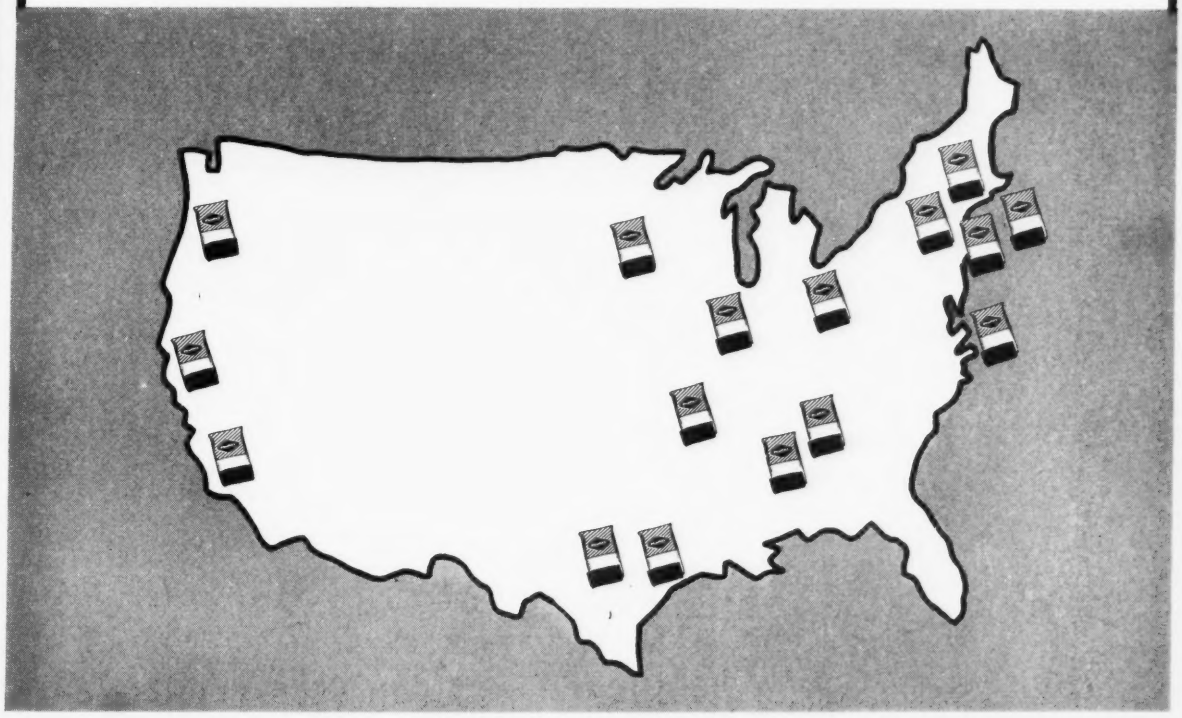
IT WILL PAY TO KNOW these designations for the various types of PLIOFLEX—Goodyear Synthetic Rubber:

PLIOFLEX 1000 —hot, nonpigmented, staining type	PLIOFLEX 1006 —hot, nonpigmented, nonstaining type	PLIOFLEX 1502 —cold, nonpigmented, nonstaining type	PLIOFLEX 1703 —cold, oil masterbatch (25 parts oil), nonstaining type	PLIOFLEX 1710 —cold, oil masterbatch (37½ parts oil), staining type



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plus service and technical help on **Plioflex**

Stretched across the country is a network of sales offices, warehouses and plants which work in unison toward a single goal. That goal is to give you the ultimate in service and technical assistance on PLIOFLEX—Goodyear Synthetic Rubber.

In the sales offices you'll find technically trained representatives who are able and anxious to keep you fully posted on any new developments or established techniques on the use of PLIOFLEX. In the strategically located warehouses you'll find experienced staffs who know how to fill orders promptly and properly. And in the plants, production and laboratory personnel whose prime objective is to maintain the highest standards of product quality and uniformity.

PLIOFLEX is the family name for a series of styrene rubbers. They include "hot," "cold" and oil-extended types, with emphasis on the nonstaining polymers which are ideally suited for light-colored applications. Learn more about PLIOFLEX by writing, on company letterhead, for the free brochure, "PLIOFLEX" to:

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President, The Hertz Corporation

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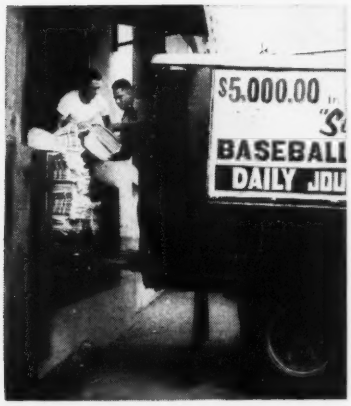
HERTZ, world's largest rental fleet proves

RAYON CORD

Walter L. Jacobs, President of The Hertz Corporation, says—"Ours is probably the most diversified trucking operation in the world. As a truck rental company, we must meet the separate needs of a variety of customers in all types of industries. And we have found from experience that trucks equipped with RAYON CORD TIRES are ideally suited to do a better job in any given situation. That's because Rayon Cord Tires stand up better, even under the roughest of driving conditions.

"We estimate that our 15,750 trucks will run up a total of 200,000,000 miles this year—and all but a small percentage will be covered by rugged Rayon Cord Tires! Because our customers put our trucks to almost every kind of use imaginable, we must be sure our tires will stand up under all kinds of road and load conditions. That's why we use Rayon Cord Tires. They can take it!"



THE NEWS GETS THERE ON TIME. "Some of our biggest customers in New York are the newspapers. It's a newspaper's job to get the news to the public—fast. Newspapers aren't in the trucking business, and we relieve them of all the "headaches" they would otherwise have by supplying them with trucks on long-term leases. Our own "headaches" are considerably lessened, thanks to Rayon Cord Tires. Their long-lasting strength keeps maintenance costs down—and as all truckers know—that's where profits lie."

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TIRES PAY OFF!

Truckers say that tires made of Rayon Cord are better for any and all kinds of trucking. Records show that more truckers use RAYON CORD TIRES than any other. They can rely on Rayon because Rayon pays off!

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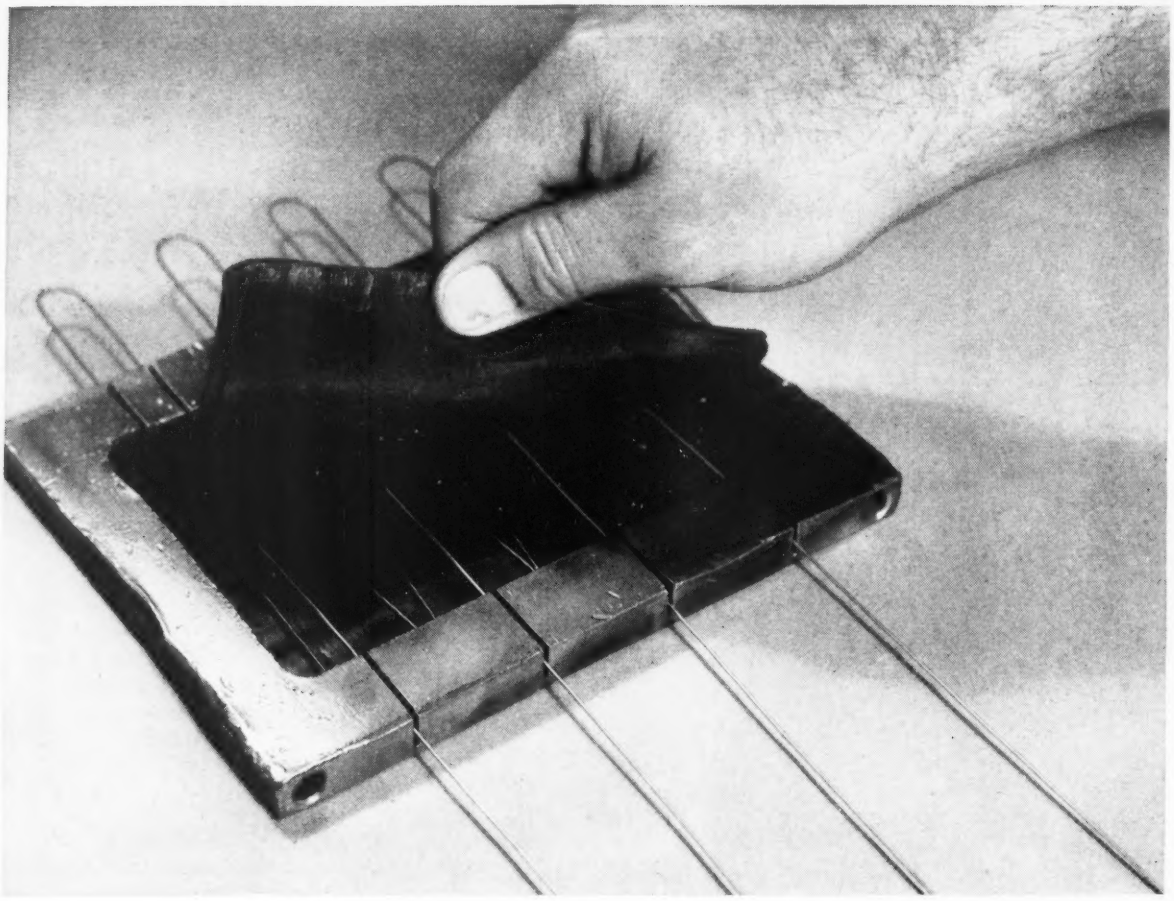

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to help your wire do a better job!

• It doesn't pay to take things for granted. That's why extensive wire research goes on *all* the time at National-Standard — behind-the-scenes work that time and again helps our customers speed operations, save material, improve their products and cut costs.

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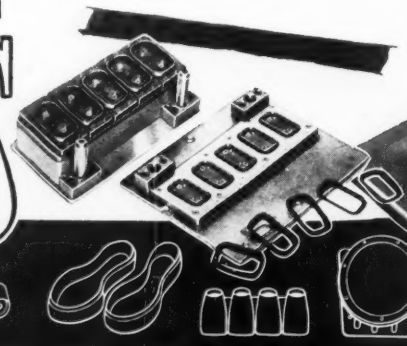

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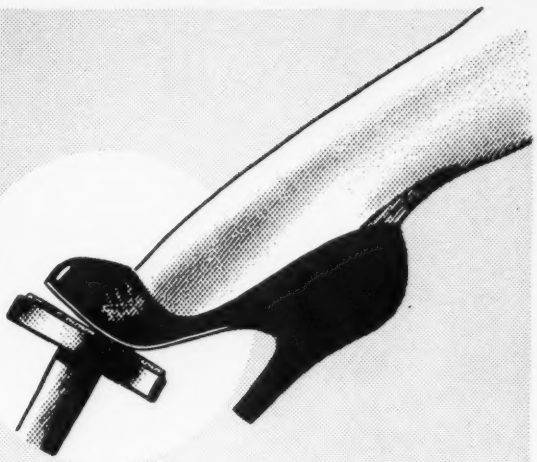

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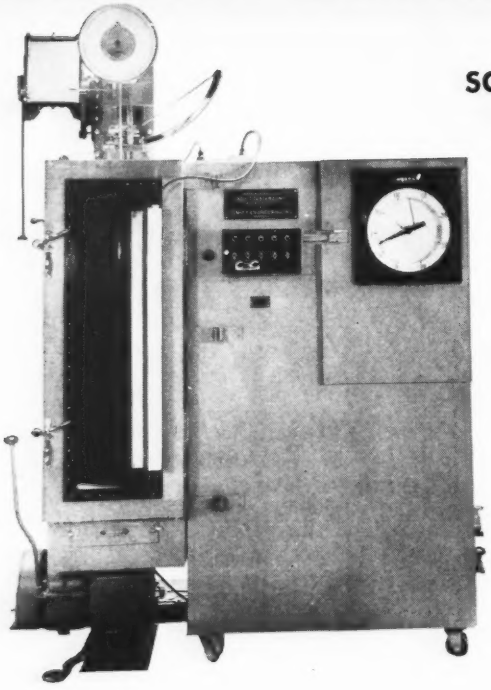
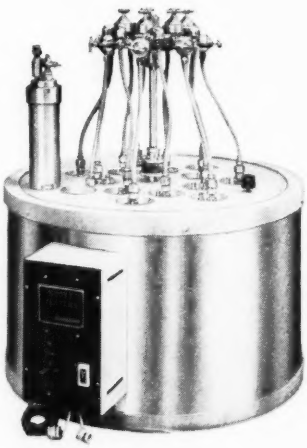


SCOTT MODEL L-8 HOT-COLD TESTER
for tensile tests from −70° to +550°F

Scott Model L-8 incorporates a self-contained conditioning unit with electric heaters, a circulating fan, Brown temperature recorder, control panel for manual operation, refrigeration coils for dry ice cooling which when coupled with the electric heaters and automatic controls allow for temperatures from minus 70° to plus 550°F. The testing instrument itself has an illuminated glass-front enclosure to maintain temperature; or can be operated with door open, at room temperature. If you require elevated temperatures only, in the range up to 300°F., we provide a conditioning cabinet which can be attached to a standard Scott Tester, eliminating the need for purchasing a special model. Model L-8 may be supplied with the "Accr-O-Meter" Electronic Weighing System for constant-rate-of-extension testing.

SCOTT TESTER* MODEL LGP with pressure

Provides 14 individual compartments for pressure ageing in air or oxygen. Individual specimens are isolated to prevent migration. Pressures, temperatures, and ageing mediums are variable to conform with industry practice.



SCOTT TESTER* MODEL LG without pressure

For ageing at temperatures up to 450°C without pressure. Contains individual glass containers suitable for test tube ageing in air similar to ASTM Method D-865-52T for rubber, silicones, and other elastomeric materials. Ideal for swelling test in petroleum, acid, etc.

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Complete information upon request.

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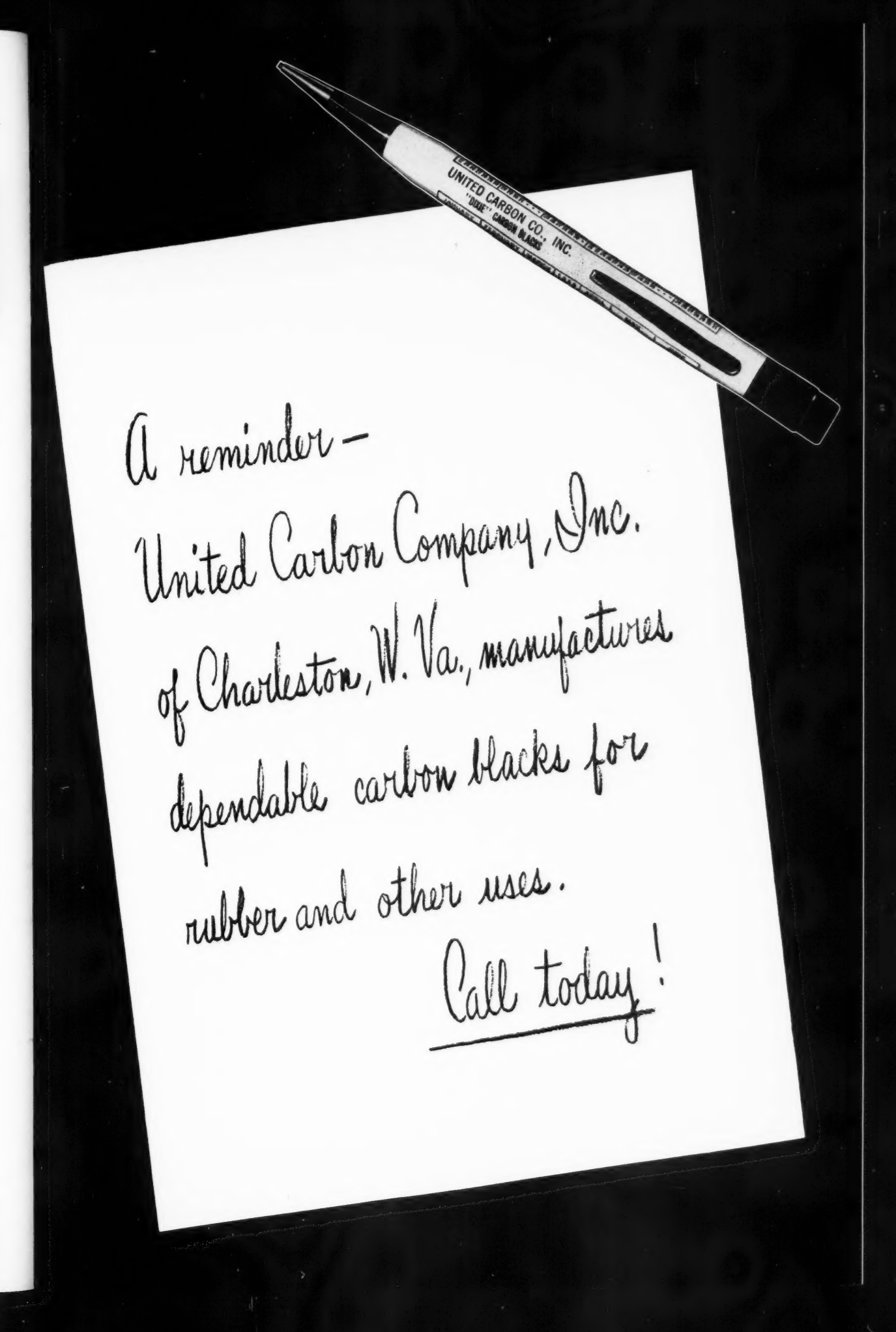
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Dixie blacks are in the front for unsurpassed performance. It is wise to standardize on United blacks and stay in the lead.

UNITED CARBON COMPANY, INC.

A subsidiary of United Carbon Company

CHARLESTON 27, WEST VIRGINIA

NEW YORK AKRON CHICAGO BOSTON MEMPHIS

BEFORE BRUSHING

AFTER BRUSHING

FAST
flash removal

REMOVING mold flash from tires is just one example of how Osborn Power Brushing is helping speed up and improve production.

Similarly, power brushing has proven the fastest and most efficient method for removing excess rubber from a virtually endless variety of molded mechanical rubber goods.

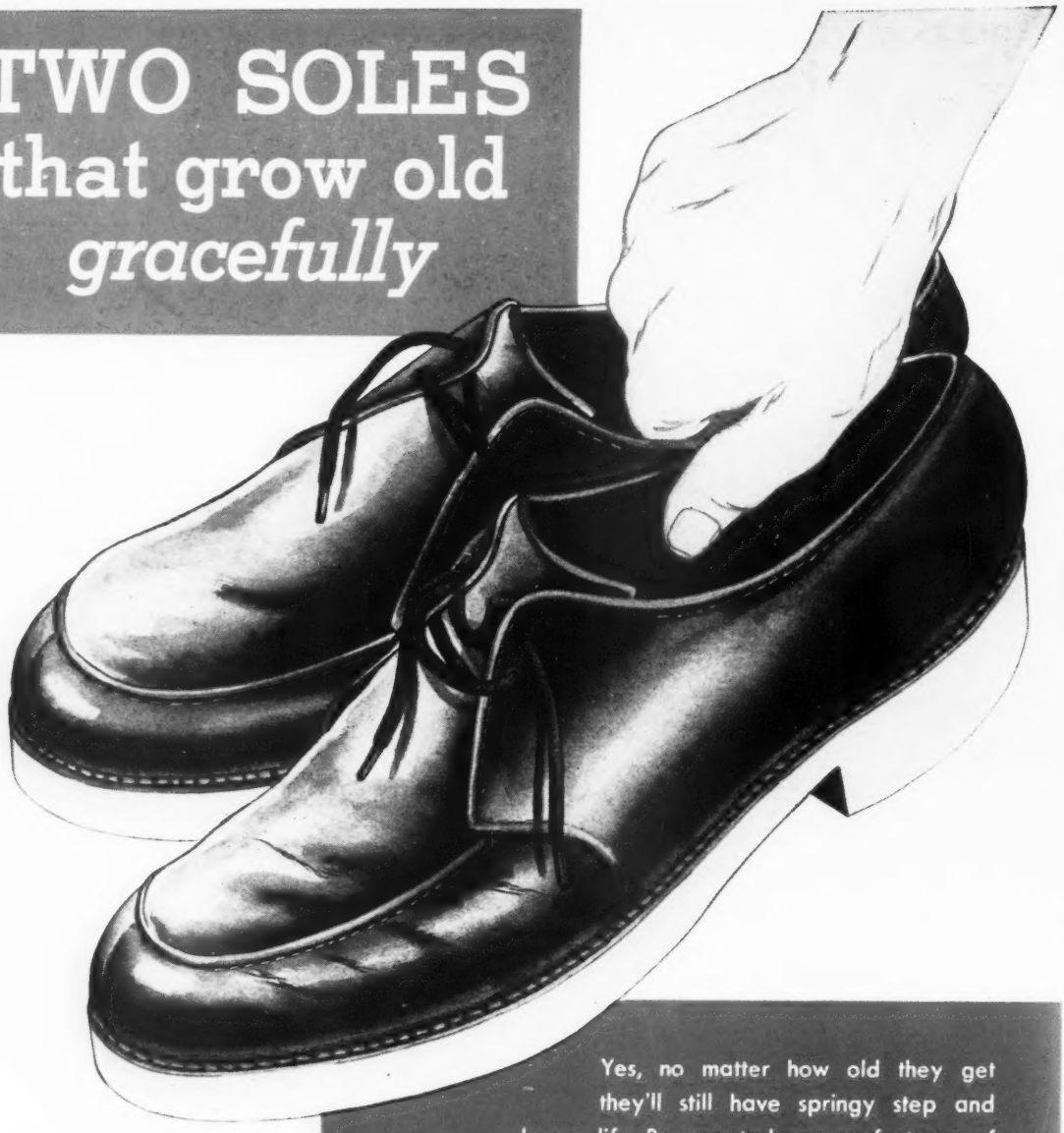
An **O**sborn **B**rushing **A**nalysis, made in your plant and at no obligation to you, will show not only *where* power brushing can be used to advantage but *how* you can use it most effectively. Write *The Osborn Manufacturing Company, Dept. M-1, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

Osborn Brushes

OSBORN

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

TWO SOLES that grow old *gracefully*



Yes, no matter how old they get they'll still have springy step and longer life. Because today, manufacturers of quality footwear use Neville Resins in compounding synthetic soles and heels, thus improving the properties of their product. They get abrasion resistance, flex-life, high tensile strength and uniform quality in the stock they use.

● *These advantages are obtainable with Neville Resins in processing other rubber products too, such as molded goods, mats, floor tile, wire insulation and mechanical goods in general!*

NEVILLE RESINS

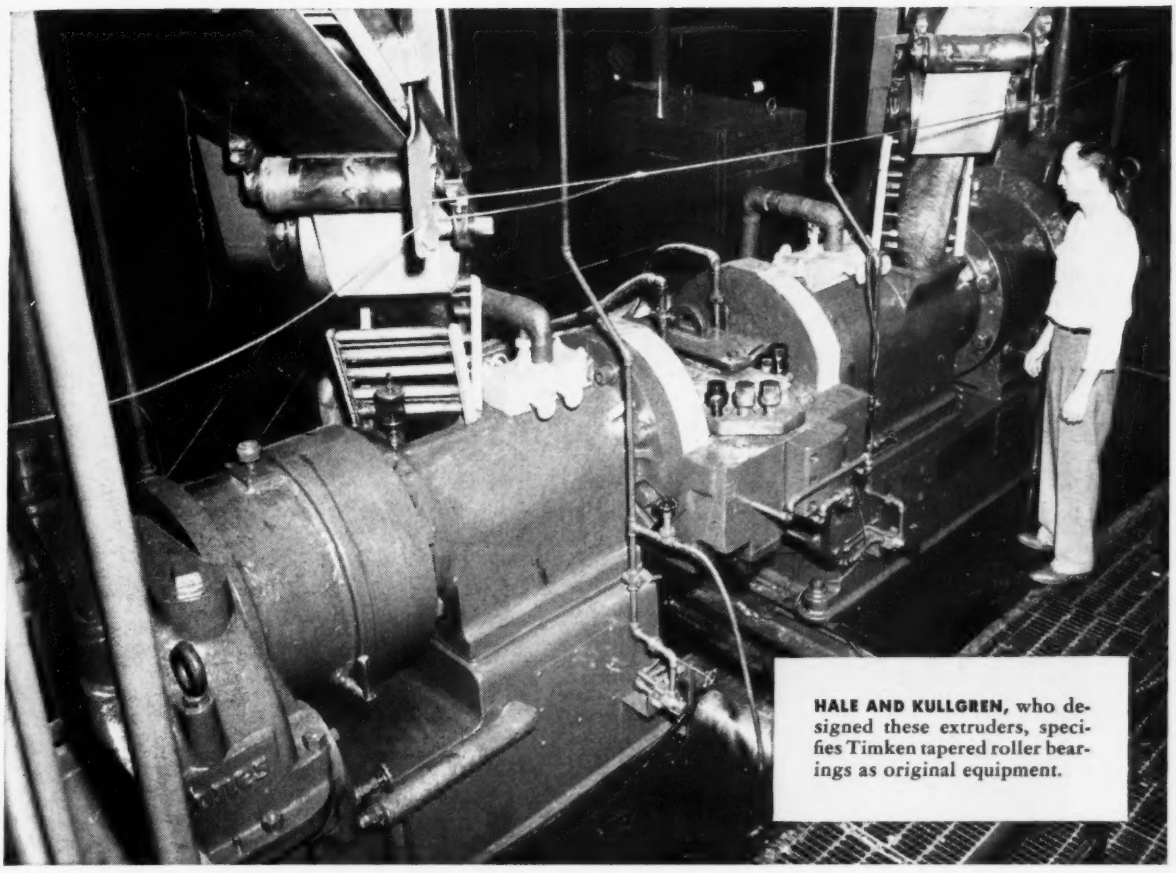
Call us for samples and information

NEVILLE CHEMICAL CO.

PITTSBURGH 25, PA.

Plants at Neville Island, Pa. and Anaheim, Cal.

R-54



HALE AND KULLGREN, who designed these extruders, specifies Timken tapered roller bearings as original equipment.

Outstanding proof that TIMKEN® bearings can take whopping thrust loads

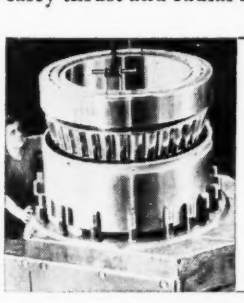
TWENTY-FOUR hours a day, year after year, these National Erie rubber extruders, redesigned by Hale and Kullgren, Incorporated, and built by Aetna-Standard Engineering Company, are kept in continuous operation.

Timken® tapered roller bearings are mounted on sleeves in the independent thrust units of these machines. As a result of their tapered construction, Timken bearings carry thrust and radial loads in any combination. Because of the tremendous thrust load encountered in this application, a large, steep-angle bearing was specified.

Nickel-rich Timken fine alloy steel, made in our own mills, is case-carburized to provide a wear-resistant surface over a tough, shock-resistant core. This results in longer bearing life and trouble-free performance under grueling conditions.

In no other bearing can you get the combination of advantages which Timken bearings give you. Specify Timken bearings in the equipment you build or buy. Look for the trade-mark "Timken" stamped on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



ROLL NECK BEARING ENGINEERING SERVICE

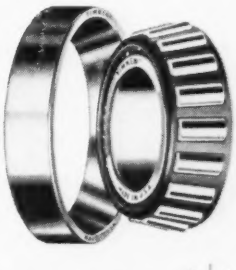
Our field and service engineers have had years of experience with problems of roll neck bearing design and operation. They'll help you select bearings and design mountings.

Only Timken tapered roller bearings have these advantages: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. nickel-rich Timken alloy steels.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ↓ AND THRUST → ← LOADS OR ANY COMBINATION →←

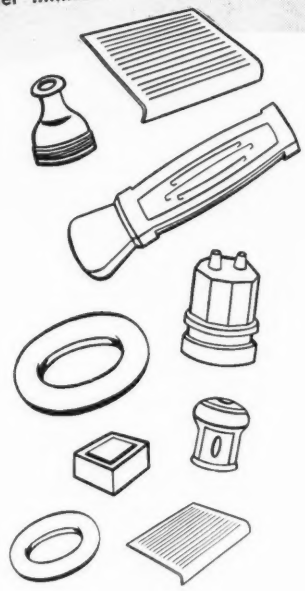
especially for MOLDED rubber products

use MOCCASIN RECLAIM

Low Cost-Easy Processing
Good Mold Flow

TYPICAL FORMULATIONS

	A-485-B	A-485-4
MOCCASIN Reclaim	62.50	45.00
Brown Crepe	13.60	4.70
Mineral Rubber	—	13.00
Zinc Oxide	1.60	.60
Stearic Acid	.60	.20
Antioxidant	.40	.40
FEF Black	—	8.00
Soft Clay	—	10.50
Whiting	17.00	10.50
Process Oil	2.70	6.00
Benzothiazyl disulfide	.43	.37
DOTG	.14	.10
Sulfur	1.03	.63
	100.00	100.00
Estimated Lb. Cost	.1091	.0741
Specific Gravity	1.30	1.34
Volume Cost	.1418	.0993
Tensile p.s.i.	800	475
Elongation %	350	275
Durometer	50±5	70±5



Pequanoc's **"Moccasin"** is a clean-molding reclaim which makes an ideal combination between low cost and easy workability for economical molding. Since its introduction to the rubber industry, it has gained wide acceptance and broad usage so that today it forms an integral part of numerous industrial and consumer products.

Other applications for the use of **"Moccasin"** are continually being developed. Consider its use in **YOUR** product . . . as a low-cost, economical ingredient in your formula. Consult Pequanoc on your particular reclaim problem. Send today for a free sample of **"Moccasin"** and Pequanoc's latest Specification Sheets.

MOCCASIN A MODIFIED WHOLE TIRE STANDARD RECLAIM

Pequanoc Rubber Co.

MANUFACTURERS OF RECLAIMED RUBBER
MAIN SALES OFFICE and FACTORY: BUTLER, N. J.

ONE MORE LATE SOLVENT SHIPMENT, AND—

BUT BOSS— OUR SUPPLIER PROMISED...
THAT'S NOT ALL—THE QUALITY OF THAT LAST SHIPMENT JUST WASN'T UP TO PAR. IT'S COSTING US MONEY, SO DO SOMETHING!
CLICK!

The Skellysolve Man Explains The Skellysure System!

1) Your order is phoned directly to the Skellysolve plant.

2) Nine times out of ten your car is shipped the next day.

3) Car number and shipping information are sent to you promptly.

4) Skellysolve is quality-checked during production and before it is shipped.

5) Technical service—backed by 25 years of Skelly development—is available to you.

LATER
SWITCHING TO SKELLYSOLVE STOPPED OUR DELIVERY PROBLEMS!
THE BOYS IN THE PLANT GO FOR SKELLYSOLVE QUALITY, TOO
Skellysolve
SKELLY OIL CO.

When solvents are so important to your business, why take chances on quality or delivery? Join the companies who are switching to Skellysolve.

Les Weber
Manager Skellysolve Sales

SKELLY **Skellysolve**

SKELLY OIL COMPANY
Industrial Division
605 West 47th Street, Kansas City 41, Mo.

Skellysolve for Rubber and Related Industries

Applications

SKELLYSOLVE-B. For making quick-setting cements for the shoe, tape, container, tire and other industries. Quick-drying, with no foreign taste or odor in dried compound.

SKELLYSOLVE-C. For making quick-setting cements with a somewhat slower drying rate than those compounded with Skellysolve-B.

SKELLYSOLVE-D. For cements and variety of manufacturing operations. Good odor. Quick drying. Minimum of heavy, greasy compounds.

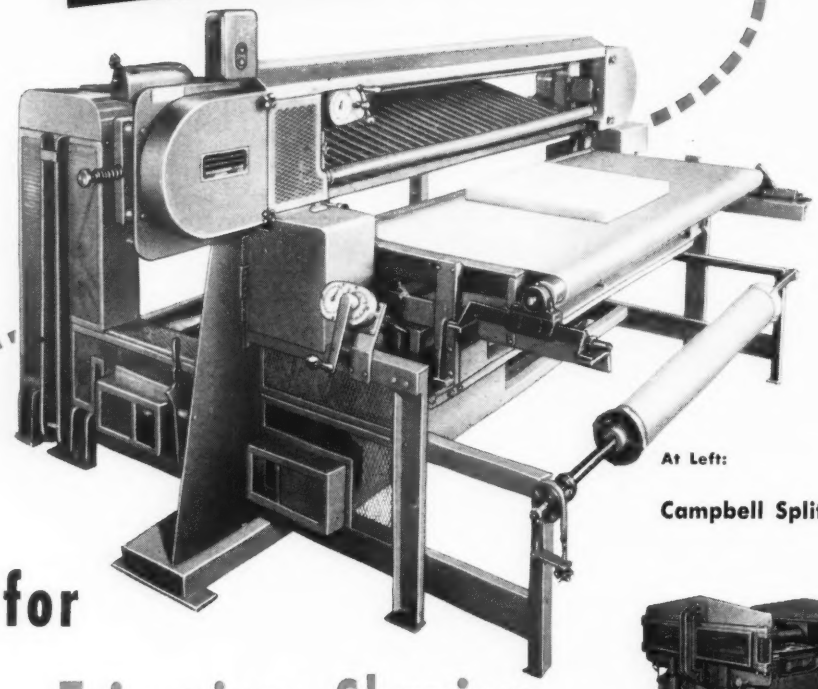
SKELLYSOLVE-H. For general use in manufacturing operations and cements, where faster evaporation rate than that of Skellysolve-D is desired.

SKELLYSOLVE-E. For use wherever a relatively slow drying solvent is desired.

SKELLYSOLVE-R. For general use in tire building and a variety of other manufacturing operations and cements. Reduces evaporation losses. Medium quick final dry. Lessens bloating and skinning tendency.

CUT PLASTICS EASIER!

WITH **Campbell** SPECIAL MACHINERY

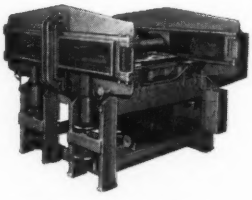


At Left:

Campbell Splitter

for

Cutting, Trimming, Shaping



Roller Die Cutter

Cushion Cutter

many different materials including Polyurethane, Polyester and Polyvinyl Plastics, Foam Rubber, Rubberized Hair, Felt, etc. With the Campbell Splitter, Roller Die Cutter and Cushion Cutter you can take stock in slabs, sheets and rolls and reduce the material to the exact size, shape and thickness you need for your job. Speed every trimming, cutting and shaping operation in your shop with FEMCO-Built Campbell Designed Special Machinery.

Write today for complete price information and illustrated brochure on any or all 3 of the machines shown here. Send us your stock for a trial cut without obligation.

The FALLS ENGINEERING AND MACHINE CO.

Established 1917

1734 FRONT ST., CUYAHOGA FALLS, O.

you **can** cut costs substantially
with this

lowest priced

LOW TEMPERATURE, SYNTHETIC RUBBER PLASTICIZER

flexricin® P-4

Check these 6 important points:

- ✓ for compounds that meet government specifications
- ✓ equivalent in performance to higher priced plasticizers
- ✓ excellent low temperature properties
- ✓ outstanding oil and fuel resistance
- ✓ priced under 35¢ per pound
- ✓ trade accepted

Join the swing to Flexricin P-4 — You'll cut your plasticizer costs without sacrificing performance!

THE Baker CASTOR OIL COMPANY
ESTABLISHED 1857

120 BROADWAY, NEW YORK 5, N. Y.

***investigate** these*
Oil and Solvent Resistant Processing Aids

1. For general milling - **POLYCIN®**
2. For extrusion and molding - **CASTORWAX®**

Mail this convenient coupon for samples and data sheets

RW-115

THE BAKER CASTOR OIL CO.
120 Broadway, New York 5, N. Y.

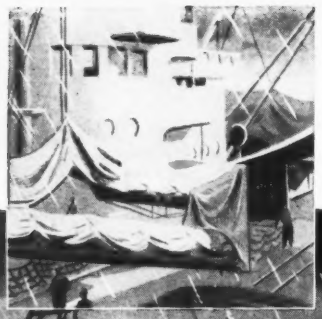
Please send me samples and data sheets on

☐ **Flexricin P-4** ☐ **Polycin** ☐ **Castorwax**

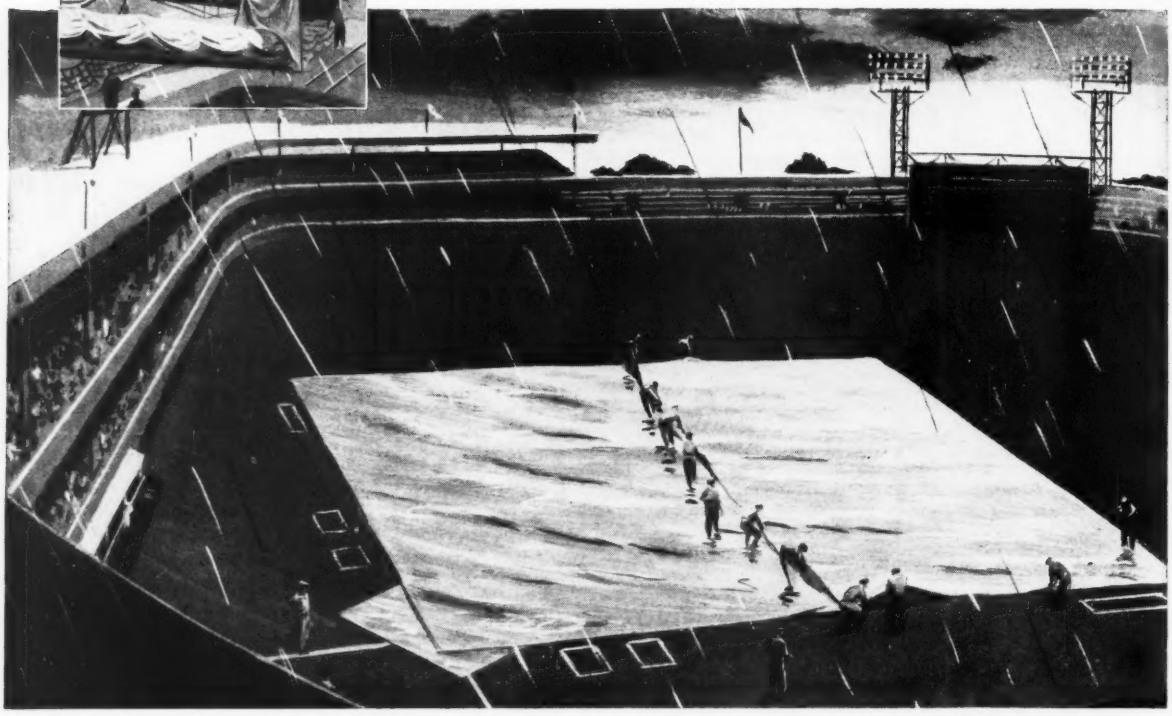
NAME_____

ADDRESS_____

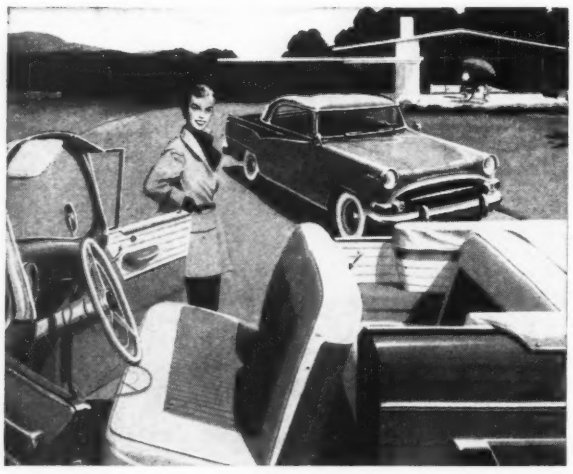
CITY_____ **STATE**_____



WELKOTE—Wellington Sears nylon backing fabric, when neoprene or vinyl-coated, combines light weight plus strength for a multitude of protective covering uses. Besides all-weather hatch tents for shiploading, these include playing field covers, machinery and freight tarpaulins, fumigation tents, etc.



Wellington Sears fabrics back up the versatility of these coated materials



For coated auto and furniture upholstery, luggage, handbags, wall coverings and many other end uses, Wellington Sears backing fabrics include cotton sheetings and drills, twills, sateens and ducks; spun rayon, "Welkote" filament nylon and other synthetics; "KnitKote" cotton knit fabric; "Lantuck" and "Lantuck-NR" (nylon-rayon) non-woven fabrics. All end-use "engineered."

American industry today is setting no limits to the possible uses of coated materials. And there's more to these materials than meets the eye. Beneath the colorful and serviceable surface, there is a backing fabric that provides the basic strength.

But there's still more to this "inside" story. Because of special problems of tear-strength, durability, flexing, weather resistance, tailoring qualities, adhesion and the like, this backing fabric must be carefully *engineered* for each type of application.

This is where Wellington Sears enters the picture. Nowhere else will you be able to match our many decades of experience with fabrics of this type. And nowhere else will you find such a complete range of different base fabrics for every conceivable plastic and rubber coating use.

Wellington Sears makes the backing fabric only—not the finished coated product. So, if you have a coating problem—or any problem that involves fabric in combination with rubber or plastics—let our experience go to work for you. For booklet, "Modern Textiles For Industry," address Dept. H11.

Wellington Sears

A Subsidiary of West Point Manufacturing Company

FIRST in Fabrics For Industry

WELLINGTON SEARS COMPANY, 65 WORTH STREET, NEW YORK 13, N. Y.

close temperature control

flood lubrication

efficient zero clearance

low maintenance

the points add up

. . . add up to extremely high efficiency coupled with absolute economy. Press the control button of a Shaw Calender and you receive a sum of all the experience, productive facilities, research results, and specialized knowledge concentrated in one grand total—better production.

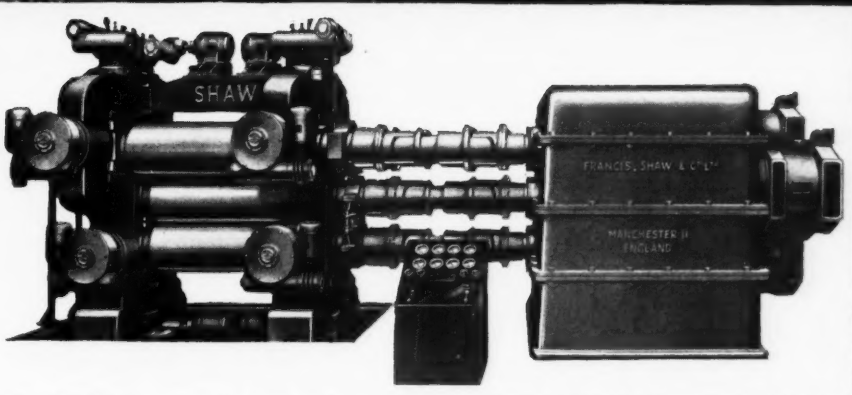
The machine illustrated is a 4-roll inverted L type with each roll driven by its own variable speed motor through a unit gearbox.

the sum total of experience *

SHAW

PRECISION CALENDERS

Industry's headquarters for the best in Rubber & Plastics machinery



FRANCIS SHAW & COMPANY LIMITED MANCHESTER 11 TELEX 66-357

enquiries to

FRANCIS SHAW (CANADA) LIMITED GRAHAM'S LANE BURLINGTON ONTARIO CANADA

TELEPHONE: NELSON 4-2350 TELEGRAMS: CALENDER BURLINGTON ONTARIO

2060

SERVING THE HEART OF THE RU

New laboratory
and
sales office
at
213 West Bowery Street
Akron, Ohio

Modern and complete technical service facilities, together with our Akron and Cleveland sales offices, have been established at this new address. In this location, Witco-Continental aims to attain new "highs" in the promptness and efficiency of our technical service for the rubber industry.

For Witco-Continental service in the Akron area, call POrtage 2-8881. In Cleveland continue to call CHerry 1-0583. Elsewhere, contact your nearest Witco sales office.

WITCO CHEMICAL COMPANY
CONTINENTAL CARBON COMPANY

122 East 42nd Street, New York 17, N. Y.

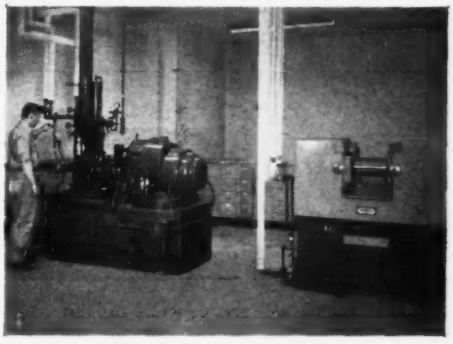
WITCO

35 Years of Growth

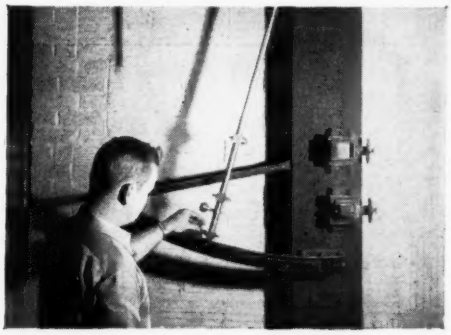
Chicago • Boston • Akron-Cleveland • Atlanta • Houston • Amarillo
Los Angeles • San Francisco • London and Manchester, England

RUBBER INDUSTRY

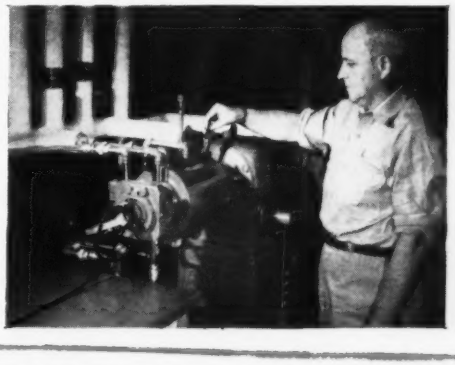
Entrance to Witco-Continental's office and technical service laboratory at Akron, Ohio.



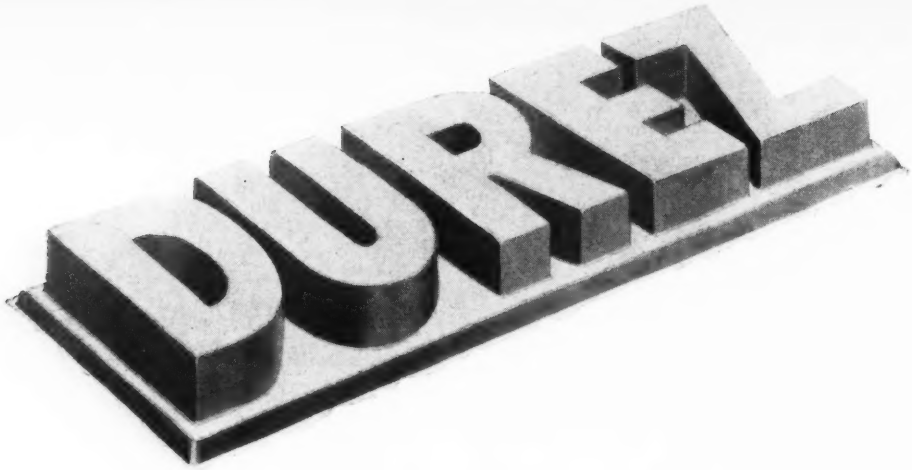
Inside Akron laboratory. Banbury mixer compounds rubber formulations. Rubber mill at right.



Rebound machine tests resiliency of rubber compounds containing Continental Carbon Blacks.



Tuber determines extrusion characteristics and provides samples for subsequent testing.



. . . wherever there's a reason for RESIN

IN HARD AND SEMI-HARD STOCKS

Special Durez phenolic resins are completely compatible with nitrile rubbers. Chemical reactivity causes vulcanization with greatly increased strength, hardness, stiffness, abrasion resistance, heat and chemical resistance.

Our Durez resins have a plasticizing effect during processing. When set, they contribute to hardness, stiffness, and wear resistance in GRS stocks, and in blends of GRS and natural, straight natural, and Neoprene.

IN SOLVENT-TYPE ADHESIVES

Resins are used with nitrile rubber, natural rubber, or Neoprene to produce adhesives that form strong bonds which increase in strength on aging. Another interesting use of Durez resins: as an adhesive for bonding cured and uncured nitrile rubber stock to various metals during the bonding operation.

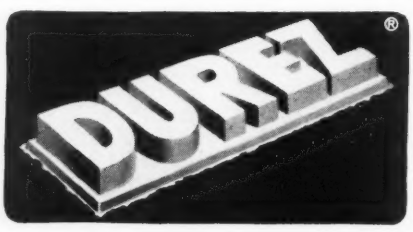
IN SYNTHETIC RUBBER LATICES

Water-emulsifiable resins are used for reinforcing and hardening latex films. These benefits are conferred on nitrile films in outstanding degree. There is a Durez special resin also for use with high-styrene-butadiene latex.

YOURS FOR THE ASKING — we'll gladly furnish technical data and help you select the phenolic resin best suited to your needs. As a starter, let us send you our newest bulletin on Phenolic Resins in Rubber.

DUREZ PLASTICS DIVISION
HOOKER ELECTROCHEMICAL COMPANY
211 Walck Road, North Tonawanda, N. Y.

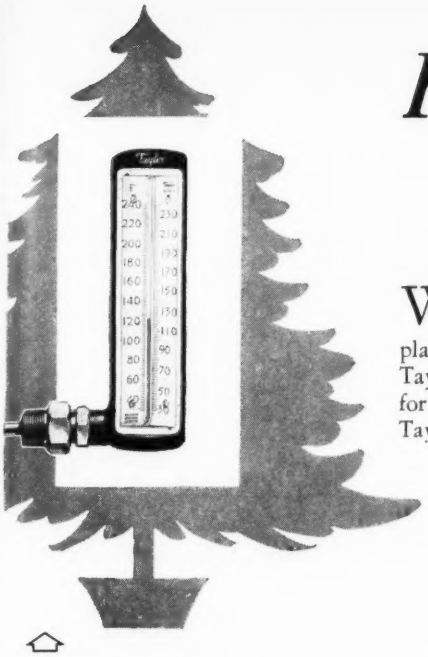
34 years of Leadership in Meeting Industry's Need for Phenolics



PHENOLIC RESINS
- MOLDING COMPOUNDS
- INDUSTRIAL RESINS
- PROTECTIVE COATING RESINS

Four Xmas Presents for men in Control!

WHETHER your business is making tires, foam rubber or mechanical goods, you need complete control. And whether he's in control of a platen press or the company's finances, he'll welcome instrumentation by Taylor because it's accurate, dependable, and guards the company's reputation for uniformity of product quality. Call your Taylor Field Engineer, or write Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

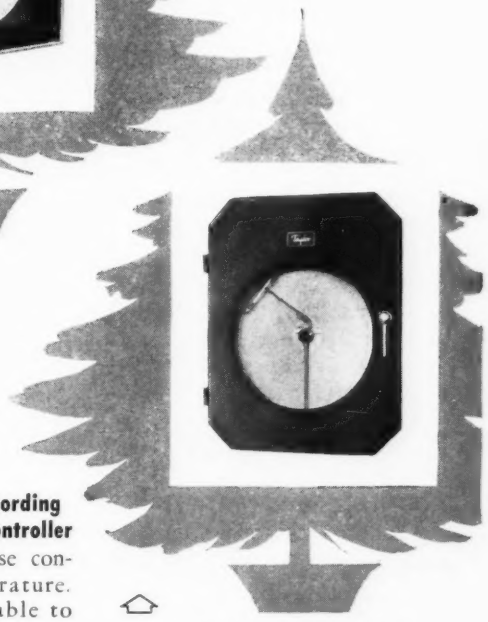


Taylor Industrial Thermometer
Ideal wherever an accurate check is needed on recording or controlling instruments. Available in many standard ranges and mounting angles. BINOC* tubing makes it 3-times-easier-to-read.

FLEX-O-TIMER* Timed Program Controller
Precisely times the sequence and operation of the processing cycles of platen presses or tire and tube presses. Handles up to 8 functions—automatically. Direct settings give greater accuracy, speed and convenience.

FULSCOPE* Recording Temperature Controller
Gives you close control of temperature. Easily adaptable to your processing requirements. Rugged, dependable—proven in the field for the past 16 years.

*Reg. U.S. Pat. Off.



Taylor Pressure Recorder
Provides a continuous chart record of one to three related pressures. Provides a check on the efficiency of both operators and equipment for greater operating economy. Rugged, yet adaptable.

Taylor Instruments MEAN ACCURACY FIRST

EXTRUDE YOUR Silicone RUBBER COMPOUNDS IN EITHER OF two EFFICIENT WAYS

with this Versatile

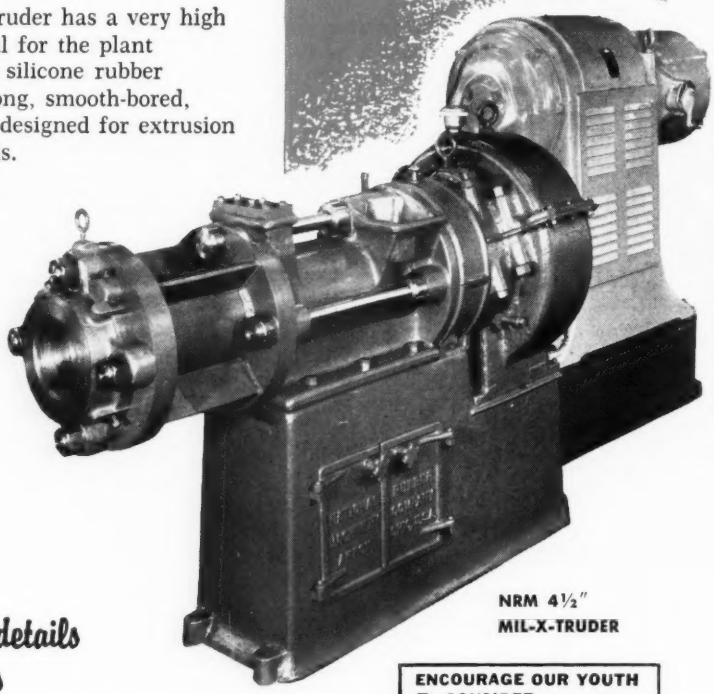
NRM

RUBBER EXTRUDER

For silicone rubber extrusion, this NRM Extruder can use either of two different types of cylinder liners — *extended* smooth-bore type, or *Mil-X-Truder®* fluted type. Both overcome the common problems of uneven screw feeding and fluctuating head pressures caused by the low-friction nature of silicone compounds. But more than that, each liner offers specific production advantages of its own . . . The Extruder — with cylinder liner selected to match predetermined extrusion requirements — will fit readily into your plant setup and assure trouble-free, economical production of top quality silicone rubber extrusions. Here's why:

WITH EXTENDED TYPE LINER the Extruder has a very high pounds-per-hour extrusion rate. It is ideal for the plant specializing in large volume, *continuous* silicone rubber production. The cylinder liner is extra long, smooth-bored, and houses an NRM feedscrew specially designed for extrusion of pre-warmed silicone rubber compounds.

WITH MIL-X-TRUDER® TYPE LINER the Extruder heats, mixes and extrudes silicone or any other rubber compound in a single operation, making it ideal for plants where various types of compounds must be extruded on one machine. Here, the cylinder liner is fluted, and houses a specially designed Mil-X-Truder® feed screw. The slower production rate of the Extruder with Mil-X-Truder® liner is far more than offset by these *plus* advantages: 1) It eliminates need of a separate warm-up mill, and 2) It accurately extrudes *any* rubber compound with equal ease.

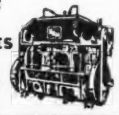


NRM 4½" MIL-X-TRUDER

Write for more details or quotations

on this Extruder, equipped with the cylinder liner that matches your rubber, or silicone rubber extrusion requirements. No obligation.

ENCOURAGE OUR YOUTH To CONSIDER The OPPORTUNITIES In ENGINEERING and SCIENCE



NRM

Creative Engineering

NATIONAL RUBBER MACHINERY COMPANY

General Offices and Engineering Laboratories:
47 West Exchange St., Akron 8, Ohio

EAST: Plants at Akron and Columbiana, Ohio and Clifton, New Jersey

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2476

New sales frontiers through COLOR

with

CALCENE · SILENE · HI-SIL

Today, color is of major concern to virtually all industrial designers and has successfully invaded such monochromatic domains as kitchen appliances, surgeon's gowns, and even tires.

Colored goods create new markets and stimulate volume in existing markets. Colored goods increase customer acceptance and satisfaction. Color opens new frontiers of sales and profits for you.

In the early days of the rubber industry, the desire for color automatically meant that utility of the goods would be sacrificed to beauty. Reinforcing fillers capable of doing both jobs simply had not been developed.

Availability of Columbia-Southern's Calcene TM and NC, Silene EF, Hi-Sil 101 and 233 now gives any compounder a range of good physical properties and permits manufacture in any desired shade or tone. Columbia-Southern reinforcing pigments range from precipitated calcium carbonate through highly reinforcing silica, providing a versatility you can employ on almost any problem.

Let us know your objectives in colored rubber goods—there's a Columbia-Southern pigment (or a combination) that will fit your needs. Write or telephone today to Rubber Pigments Department at our Pittsburgh address.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION
SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY
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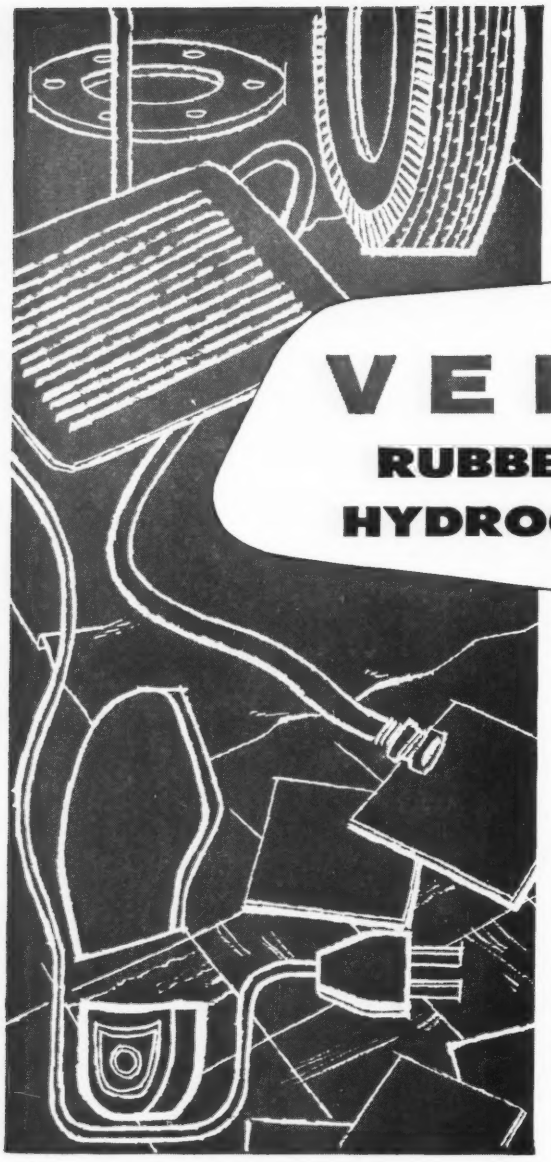

For Rubber Compounding...

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Available in Varied Melting Point Ranges

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- Effective plasticizers and softeners.
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- Ideal dispersing agents for fillers and pigments.
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Write, wire, or phone for complete information on Resins and reclaim oils

RUBBER RECLAIM OILS

Investigate these effective, economical reclaim oils to obtain high-quality reclaim rubber. Velsicol reclaim oils are suitable for a wide variety of reclaiming processes.

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MERAC

A LIQUID ACCELERATOR FOR LATEX— NATURAL and SYNTHETIC

✓ *SIMPLIFIES LATEX COMPOUNDING*

✓ *ADD DIRECTLY TO LATEX*

✓ *NO GRINDING OR BALL MILLING NECESSARY*

Merac Offers these Advantages:

1. It is a liquid accelerator which upon dilution with water is added directly to latex.
2. It is faster curing at room and elevated curing temperatures than most accelerators.
3. It imparts high modulus and tensile strength with flat curing and good aging characteristics.
4. Its use provides compounded latex formulations which are stable on storage, exhibiting only moderate changes in viscosity.

PROPERTIES

Color—	Deep red to brown
Odor—	Characteristic
Sp. Gr.—	1.034 at 20° C.

Soluble in water

For technical information write to

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Consultants for Rubber and Plastic . . .

offer

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1 **Critical Appraisal** of existing processes and equipment.

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4 **Layout Drawings** of proposed operation.

5 **Manufacturing Cost Projections** under recommended new plant operation.

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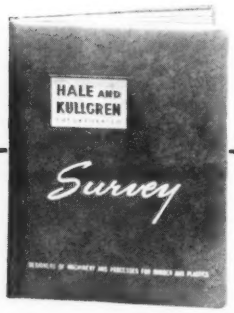

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Improved Qualities start here-

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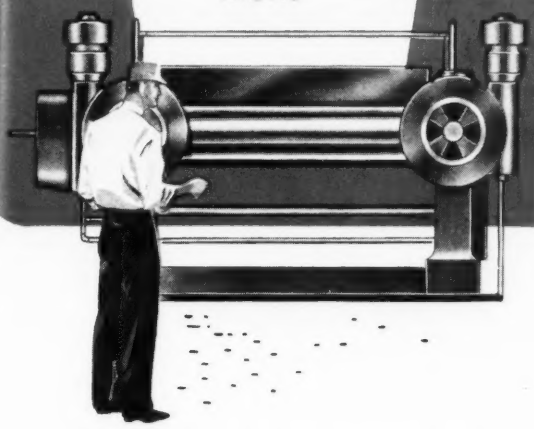

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★ *to Aid Processing*

★ *to Improve Properties*

★ *to Gain Economies*

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POLYCIZER DBS — Dibutyl Sebacate

POLYCIZER DBP — Dibutyl Phthalate

POLYCIZER 162 — Dioctyl Phthalate

POLYCIZER 332 — Dioctyl Adipate

POLYCIZER 532 — Octyl Decyl Adipate

POLYCIZER 562 — Octyl Decyl Phthalate

POLYCIZER 632 — Didecyl Adipate

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STAN-TONE MBS MASTERBATCH . . . For use in rubber and vinyl.
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STAN-TONE DRY — All types.
STAN-TONE GPE — Ground polyethylene dispersion compatible with rubber, vinyl and polyethylene.

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STABELAN HR-50 — (Fluid Paste) For all Plastisol formulations. Contains plasticizer in addition to cadmium and barium with synergized chelating agent.

STABELAN HR—PASTE . . . "Single Package" stabilizer with cadmium and barium and synergized chelating agent.

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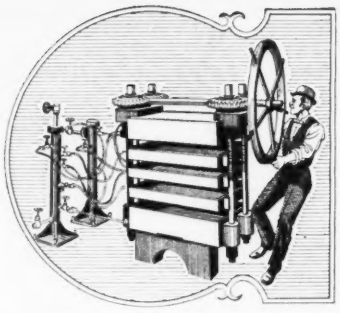
in the good old days

when Grandpa molded on this screw-operated press . . .



when one of the big names in the rubber industry was Goodrich-Tew & Company

ERIE FOUNDRY COMPANY WAS A GREAT NAME IN HYDRAULIC PRESSES

in today's rubber shop

Fiberglass is molded on ERIE Presses that anticipate all possible requirements in reinforced plastics molding. This ERIE semi-automatic, self-contained press can be arranged with *three* closing and *two* opening speeds and tonnages. In a five-speed cycle, the ram meters down in high speed from the top of its stroke—stroke length is adjustable too—automatically moves into an intermediate speed and presses at low speed. Pressing speed and pressure apply when the material is contacted. After curing, the ram starts upward at low speed—adjustable from 0 to maximum—with high stripping tonnage applying to open the toughest mold. After die break-away the ram moves into high return speed. ERIE Press shown is down-acting. Up-acting rams are optional.

ERIE Fiberglass presses produce more perfect pieces per hour. Write for bulletin.

in our 60th year

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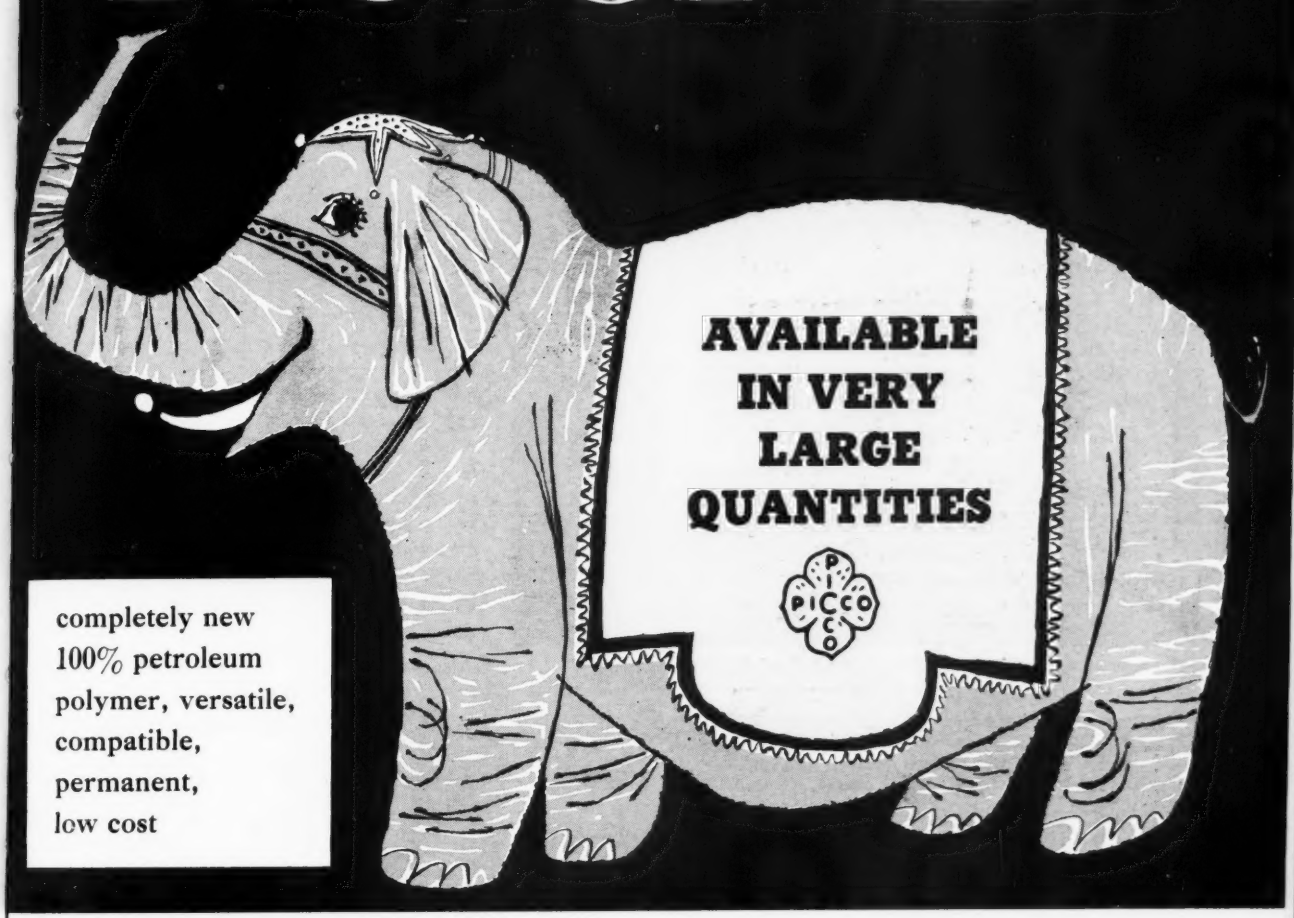
ERIE FOUNDRY CO. ERIE, PA.

Cut your materials costs with

PICCOPALE



completely new 100% petroleum polymer, versatile, compatible, permanent, low cost

The extremely low cost of PICCOPALE, and its availability in enormous quantities make this new type of petroleum resin ideal for use as a basic raw material in applications where previous types of resins were not practical. It is chemically inert—not affected by acids and alkalies; moisture-proof; compatible with waxes, rubbers, polyethylene, coumarone-indene resins, phenolics, rosins, many alkyds, vinyls, drying oils and many other materials. PICCOPALE is soluble in naphthas, chlorinated and other solvents. Available in liquid solution or in flaked or solid form.

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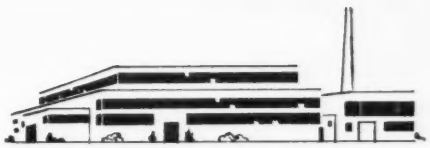

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Please send me a copy of your bulletin describing PICCOPALE and samples of grade for (application)_____

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LOW AMMONIA CENTRIFUGED LATEX—1-VX-5*

This new natural rubber latex about 62% solids eliminates deammoniation in the manufacture of latex foam, makes odor less objectionable to workers in adhesive and dipping applications, and does not retard vulcanization rates, — may even activate vulcanization systems slightly. Mechanical stability is good and total alkalinity (calculated as ammonia) is extremely low. No Santobrite is used in its preservation.

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*PATENT APPLIED FOR.

Your request for complete information on, or samples of any of these products will receive prompt attention at any of our plants.

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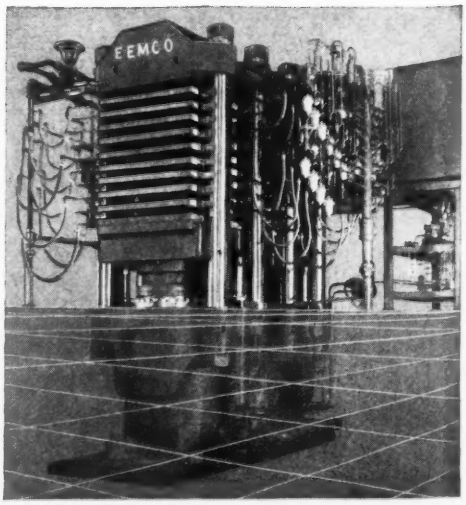

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To improve
the ozone resistance of GR-S
automotive products

use

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It is specific to GR-S

(NBC should not be used in natural rubber
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Vulcanized Oil

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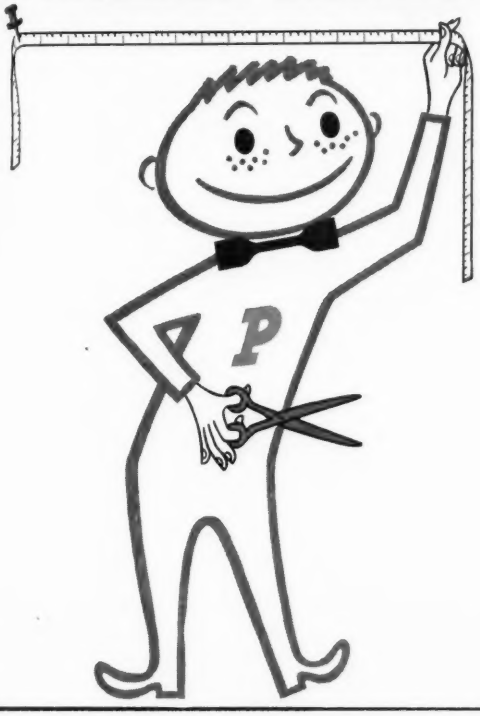
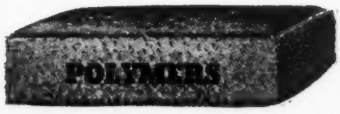


With PHILPRENE, it isn't a question of "take it or leave it". The wide variety of PHILPRENE copolymers and masterbatches allows manufacturers of rubber goods to select the exact PHILPRENE they need for their particular products.

And if you haven't already done so, find out how Phillips Sales-Service Laboratory can help in your rubber operations. Our technical facilities are at your service, without obligation. Call on our technical representative for helpful cooperation in any problem involving rubber technology.

CURRENT PHILPRENES	*Each is comparable to former GR-S with the same numerical designation except 1605 and 1803 as noted below.* HOT	COLD	COLD OIL EXTENDED
	PHILPRENE 1000 PHILPRENE 1001 PHILPRENE 1006 PHILPRENE 1009 PHILPRENE 1010 PHILPRENE 1018 PHILPRENE 1019	PHILPRENE 1500 PHILPRENE 1502 PHILPRENE 1503 NOTE: PHILPRENE 1019 AND 1503 ARE ESPECIALLY DESIGNED FOR THE WIRE AND CABLE INDUSTRY	PHILPRENE 1703 PHILPRENE 1706 PHILPRENE 1708 PHILPRENE 1711 PHILPRENE 1712
	PHILPRENE 1100 PHILPRENE 1104	PHILPRENE 1600 PHILPRENE 1601 PHILPRENE 1602 PHILPRENE 1605* *Philblack A cold rubber masterbatch	PHILPRENE 1803 similar to GR-S 1801 but incorporating 25 parts Philrich 5

PHILLIPS CHEMICAL COMPANY
Rubber Chemicals Division
318 Water Street, Akron 8, Ohio

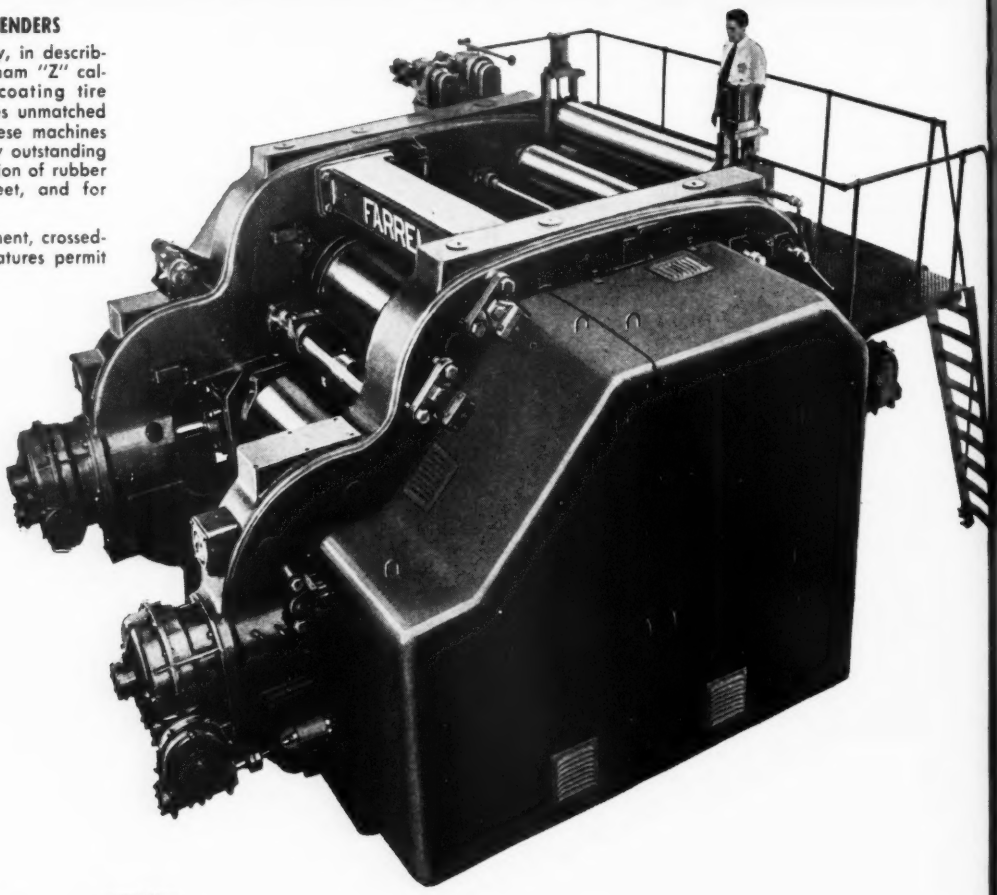
Phillips 66

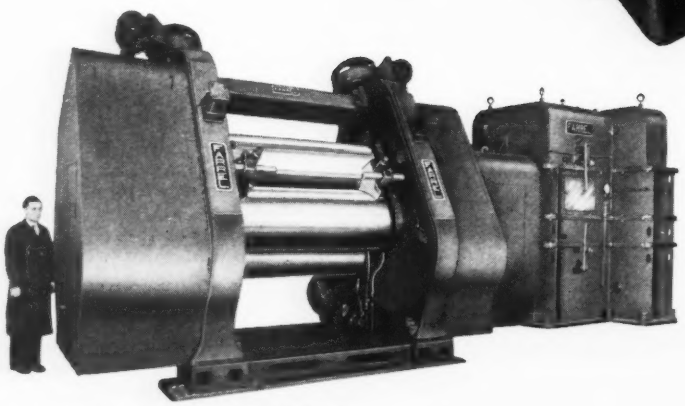
Bring your Calendering Problems to FARREL-BIRMINGHAM®...

FOUR-ROLL "Z" CALENDERS

A leading rubber company, in describing its new Farrel-Birmingham "Z" calender train for double-coating tire fabric, says that it "insures unmatched uniformity of quality". These machines have proved to be equally outstanding for the high-speed production of rubber and plastic film and sheet, and for single coating.

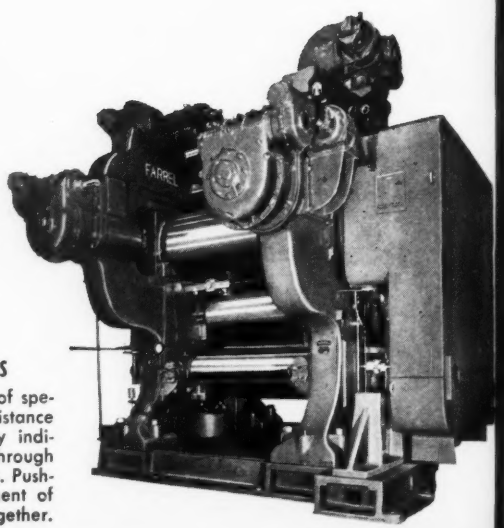
Their unique roll arrangement, crossed-axes device and other features permit full control of gauge.





THREE-ROLL TRI-ANGULAR CALENDERS

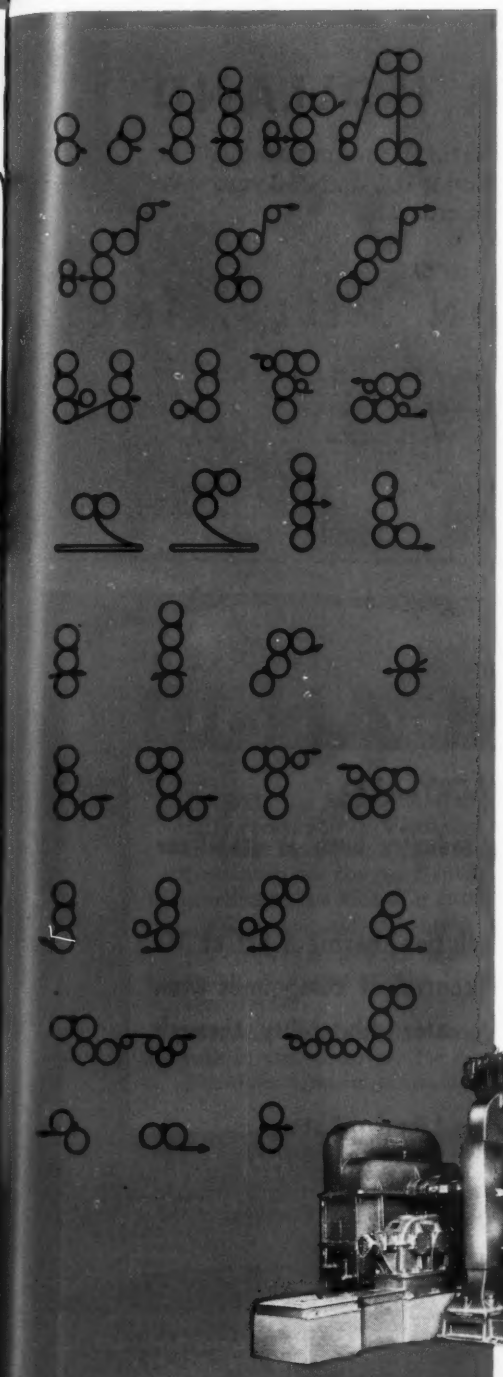
The machine of the future for any type of production requiring two calendering passes. Right-angle arrangement of rolls provides closer control of gauge and easier feeding conditions.



FOUR-ROLL L-TYPE CALENDERS

This 28" x 66" plastics calender is of specially heavy construction for high resistance to deflection. Roll adjustment is by individual motor driving each screw through high-ratio reduction worm gear units. Push-button control provides for adjustment of either roll end separately or both together.

"Calender Headquarters" since 1854



Since that time, a century ago, Farrel-Birmingham has maintained world-wide leadership in calender design and pioneered many improvements.

Of particular importance are the two most recent developments —the four-roll "Z" calender and the three-roll "Tri-angular" calender. Both of these machines have established new standards for accuracy and economy.

All of the calenders represented by the 34 diagrams shown here have been built by Farrel-Birmingham time and again. As a result, you can be almost certain that the basic design for the "specialized" machine you require has already been worked out by Farrel-Birmingham engineers and proved on the job.

But this does not mean that the calender you buy will be an off-the-shelf machine. To the contrary, physical proportions, materials, type of construction, lubrication system, gearing, special operating features—in fact, every detail of every calender is designed for a specific job.

Before you decide on a calender, call in a Farrel-Birmingham engineer. With the experience of "Calender Headquarters" behind him, he will be able to find a solution to your calendering problems. Send for bulletin 174 which describes F-B® calenders in detail.

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Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.
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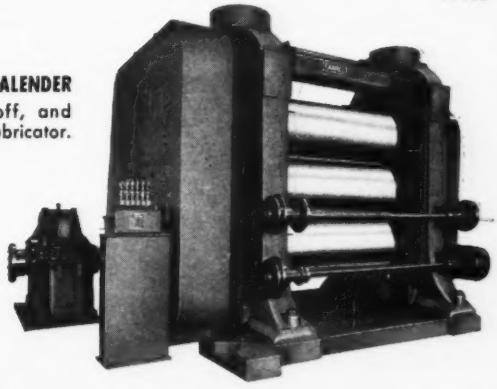
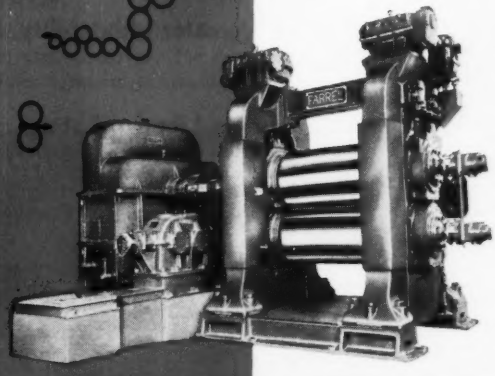
FB-965

24"x68" THREE-ROLL CALENDER
showing windup, let-off, and mechanical force-feed lubricator.





30" x 54" TWO-ROLL ASPHALT TILE CALENDER
Proportioned for great strength and resistance to deflection. Rolls are drilled beneath the chill for more effective temperature control. Gearing is enclosed in a separate Uni-drive and connected to the rolls by universal spindles.

Farrel-Birmingham®

EVERLASTINGLY PLIABLE

CLEAN-PEELING

OUTSTANDING SURFACE GLOSS

NON-FLAKING

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MINIMUM SURFACE LOAD

YET TIGHTLY FILLED

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RUBBER HOLLAND

BRATEX is available in three standard qualities, 20 and 40 inch widths, 100 and 250 yard rolls. Special size rolls to order.

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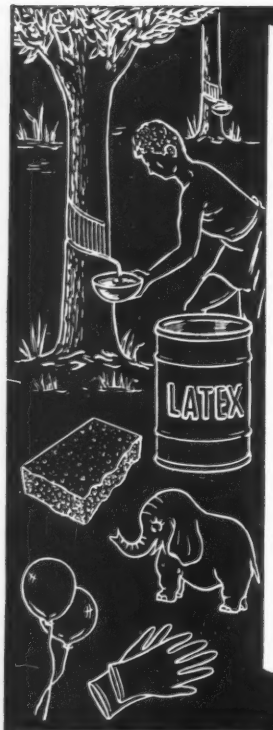

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ALCOGUM AN-10 is a 10% solution, having a pH of 10. Provides more effective viscosity control of compounds even during prolonged storage, and greater dilutability through adequate stabilization.

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to get from here....to here?

ANSWER: 21 YEARS

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As cars improved, the rubber industry grew along with them until today it is one of the largest in the country.

Monsanto has played an important role in this progress. Its complete line of accelerators, antioxidants and special materials for rubber are virtually standards of the industry. For example, Flectol* H imparts excellent heat resistance and Santoflex* AW is the standard antiozonant of the rubber industry.

For full information, send for your copy of the new catalog "Chemicals for the Rubber Industry." Write: MONSANTO CHEMICAL COMPANY, Rubber Service Dept., 920 Brown Street, Akron 11, Ohio.

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A-32
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All are high color iron oxide pigments of exceptional purity.

All are characterized by unusual brightness in mass tone and clarity in tints.

The reds in the order shown range from strong color on the light side to deeper red with bluer cast.

TESTS WITH NATURAL AND SYNTHETIC RUBBER HAVE SHOWN EXCELLENT AGING CHARACTERISTICS

Check these desirable points:

- Clean bright color and tint
- Easy dispersion and processing
- Color permanence
- Exceptional strength
- Unusual purity
- Fine particle size
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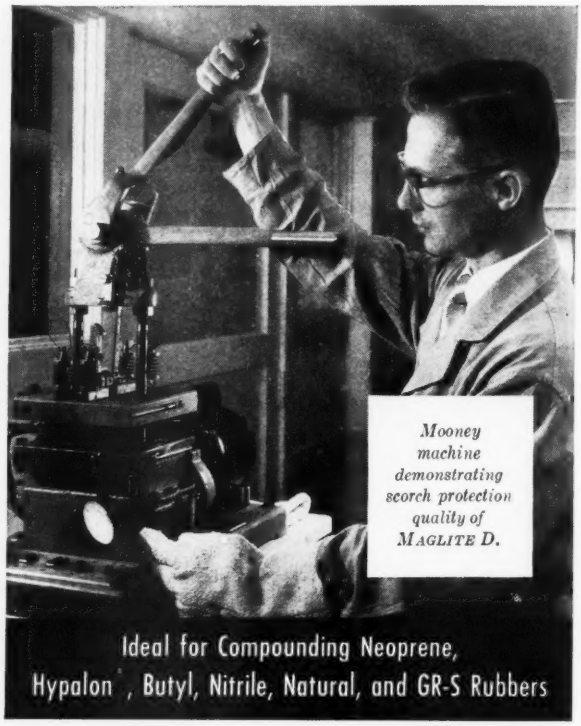

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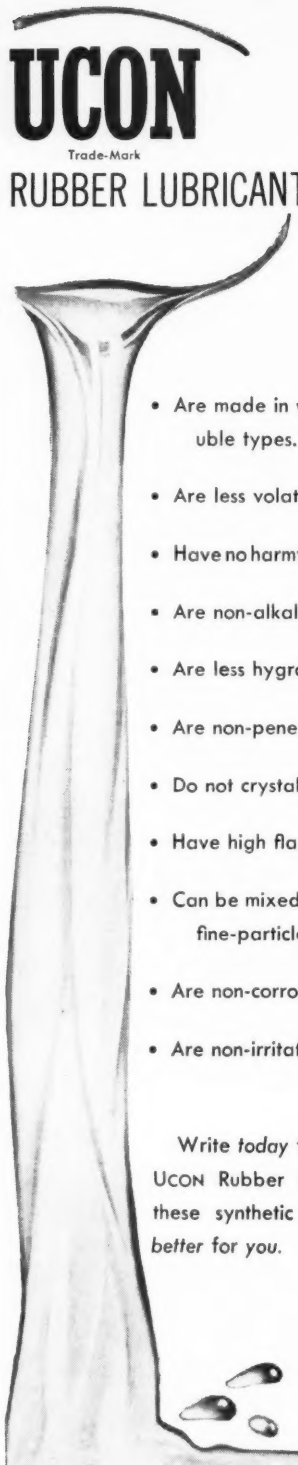

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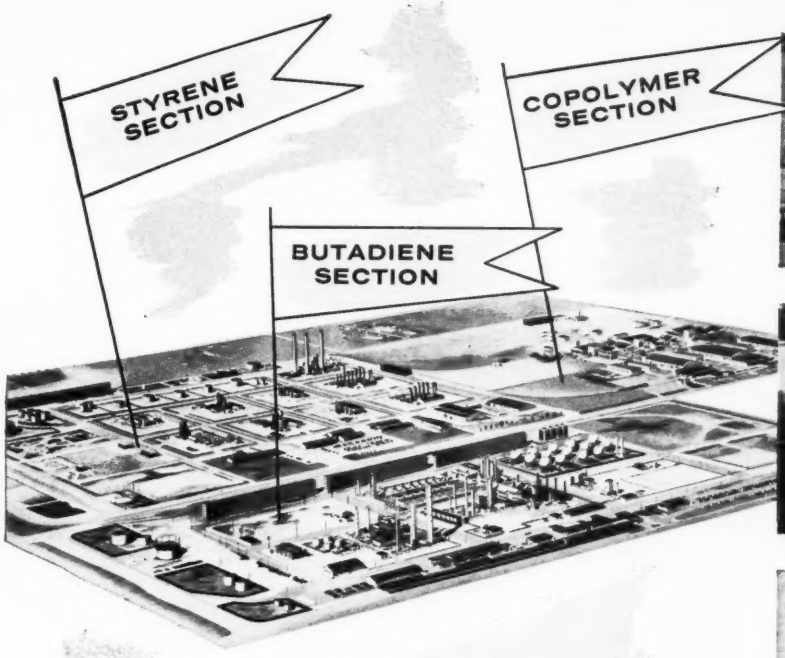

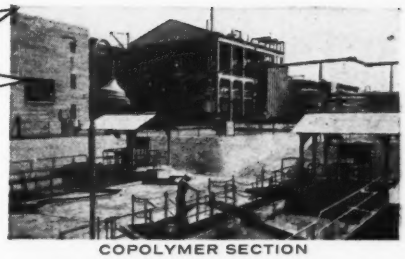
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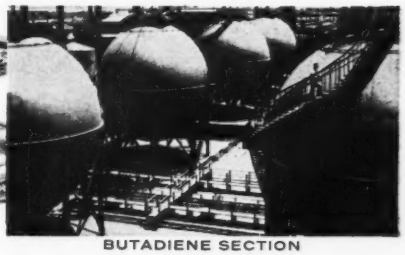
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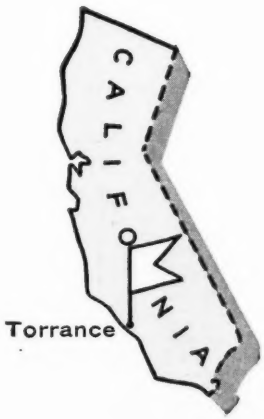

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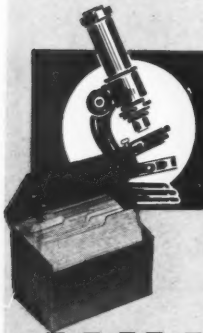

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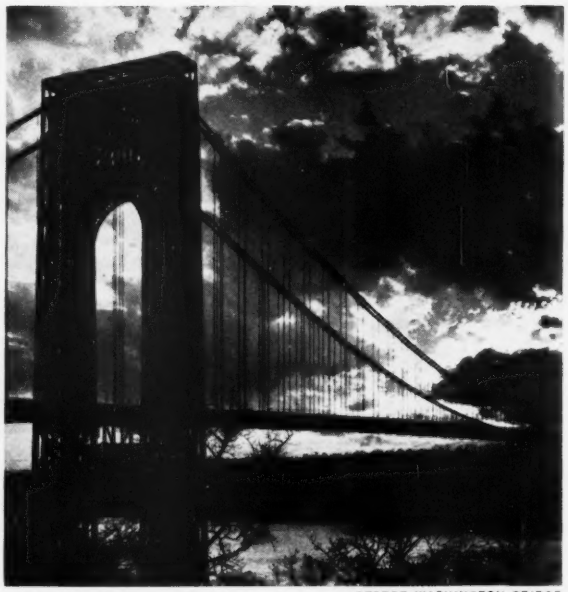

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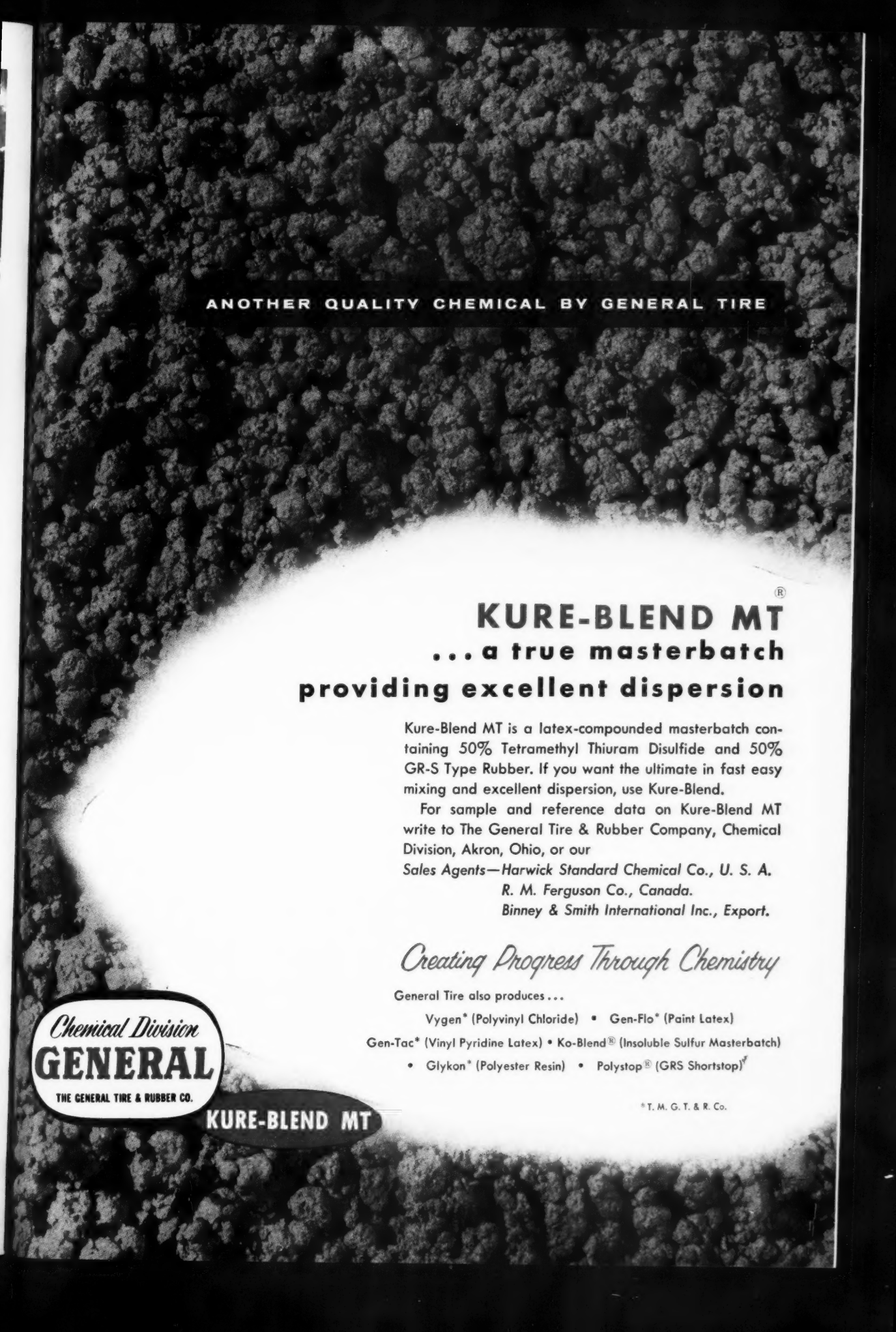
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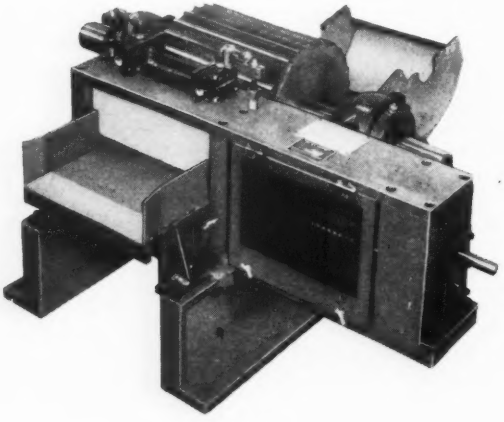

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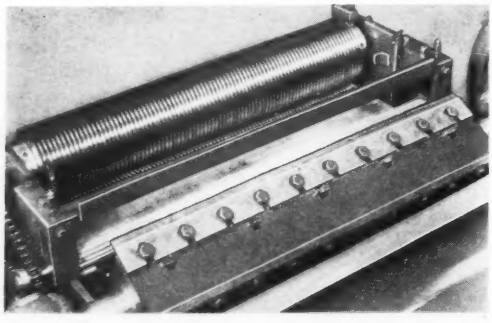

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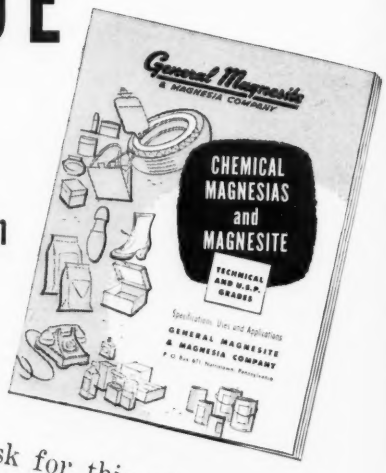

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RUBBER WORLD

NOVEMBER, 1955

VOLUME 133, NUMBER 2

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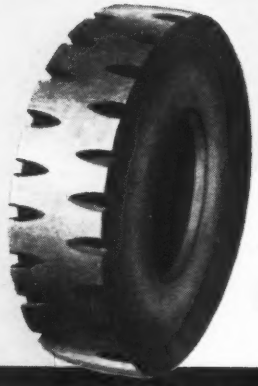

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D. M. Alstadt

Some Fundamental Aspects of Rubber-Metal Adhesion[1]

By D. M. ALSTADT

Lord Mfg. Co., Erie, Pa.

Of major significance in the production of adhesion between rubber and metal are (1) factors characterizing the rubber to be bonded; (2) factors characterizing the adhesive polymer; and (3) factors characterizing the metal.

For physical adhesion at the interfaces it is important that the unjoined phases to be bonded demonstrate the maximum possible free surface energy compatible with low interfacial energy existent after bond formation. If adequate physical adhesion at either the rubber-adhesive or adhesive-metal interface is unlikely, chemical adhesion produced by the formation of primary valence bonds must be promoted.

The most promising avenue for future development of adhesives that will have marked strength and environmental resistance is the synthesis of completely different and unique polymers and cross-bridging agents especially designed for rubber-metal adhesion use.

MUCH information has been published regarding the applicability of specific materials for the bonding of various rubbers to one or more metals. Little information, however, has been published regarding the general concepts of importance in the problem of rubber-metal union. Early writings dealing with rubber-metal adhesion were primarily devoted to descriptions of methods by which the adhesion of natural rubber to metal could be produced by the so-called brass plate and copper flash processes (1).[2] Extensive information is available regarding the general effects of plating bath compositions, rubber compound formulations, etc. on the adhesion produced by these processes that have been standard procedure in the rubber industry for years.

The brass or copper plate methods, however, because of their unpredictability, sensitivity to processing conditions, and poor resistance to chemical environment are rapidly being replaced by procedures that utilize organic polymeric adhesives for the production of adhesion. This general description of the fundamental factors operative in rubber-metal bonding will, therefore, restrict itself to considerations of those variables that are of importance in processes utilizing these polymeric agents.

An analysis of the fundamentals of polymer-metal and polymer-polymer interaction necessarily involves considerations from many fields of technology. Some of the topics discussed in this paper are normally considered to be within the field of the chemist; others are of interest to the physicist; and some are within the domain of metallurgy and engineering.

It is unlikely that the adhesive technologist will find all parts of the presented treatment to be of equal interest or significance. In order to prevent a discontinuity of

[1] Presented before the Rubber & Plastics Division, ASME, Boston, Mass., June 20, 1955.

[2] Numbers in parentheses refer to Bibliography items at end of this article.

understanding, therefore, a number of concepts have been treated from more than one point of view, and a number have been emphasized on more than one occasion. It is hoped that this procedure has not resulted in redundancy.

Processes for the bonding of rubber to metal that involve organic polymeric bonding agents are characterized by a number of important factors which can be classified as follows:

A. Factors dependent upon the structure and nature of the rubber to be bonded.
B. Factors dependent upon the nature and structure of the polymeric materials, solvents, additives, etc. present in the adhesive formulation.
C. Factors dependent upon the metallurgical state and surface nature of the metal to be bonded.
D. Factors related to a number of theoretical influences operative in any adhesive system. These factors are not restricted in their significance to the production of rubber-metal adhesion, but are of significance in most adhesive applications.

We shall describe briefly a number of these important variables and shall attempt a description of techniques of importance in the development of more useful adhesives for the rubber-metal system.

Structure and Nature of the Rubber to Be Bonded

Polarity of Base Rubber Polymer

Perhaps the most logical way to classify rubbers for adhesion study is to classify them according to their polarities. Highly polar materials are materials that contain strongly orienting electrical groups which, because of these groups, normally dissolve in active polar solvents such as water, alcohols, ketones, esters, etc. Non-polar materials contain no electrically active groups and therefore dissolve in non-polar solvents such as aliphatic heptane, aromatic benzene or toluene, and other such inactive agents. There are all gradations of polarity between the polar extremes of alcohol and water and the non-polar extreme characterized by linear unsubstituted aliphatics and unsubstituted cyclic aromatics. Chlorinated aliphatics and aromatics demonstrate a polarity somewhere between these two limits; the tendency, however, is for the chlorinated materials to be somewhat more non-polar than polar; such is particularly true when the chlorinated material possesses a large degree of molecular geometric symmetry. An illustration of representative non-polar and polar molecular characteristics is shown in Figure 1.

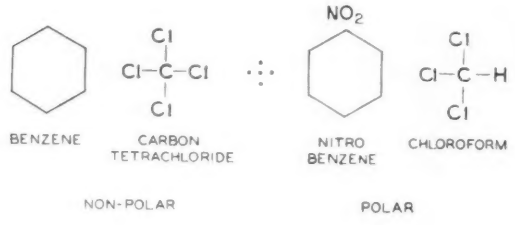

Fig. 1. Typical polar and non-polar molecules

On the basis of solubility, it is a rather simple matter to classify rubbers according to polarity. Copolymers of butadiene and acrylonitrile dissolve more easily in ketones and other active solvents than they do in non-polar liquids and can be considered polar rubbers. The polarity generally increases with the acrylonitrile content. Butadiene-acrylonitrile rubbers owe their polarity to the presence of the CN group in the nitrile monomer.

Neoprene, although still polar, is less polar than butadiene-acrylonitrile type of rubber; this fact is illustrated by the ability of most neoprene or polychloroprene stocks to dissolve in chlorinated solvents as well as in ketones and other active agents. The polarity of neoprene is primarily due to the existence of the electrically active chlorine atom in the polymer chain.

Butadiene-styrene rubber and natural rubber in the uncompounded form are almost completely non-polar in nature. They dissolve in chlorinated solvents to some degree, but are most soluble in the straight aliphatic and aromatic materials. The butadiene-styrene type of rubbers, however, are not quite so devoid of polarity as natural rubber materials.

The electrically active groups present in butadiene-acrylonitrile type rubbers and in neoprene types make the production of adhesion between such rubbers and a polymeric adhesive a relatively simple matter. Strong secondary valance, or so-called physical forces, operating between the rubber and a polar adhesive agent are often sufficient to produce adequate and durable adhesion at the adhesive-rubber interface.

The possibility of adhering butadiene-styrene polymers or natural rubbers to adhesives by polar (physical) forces alone is quite remote, and some chemical cross-bridging mechanism between the rubber and the polymeric adhesive must be introduced into the adhesive-rubber interface system. To produce adhesion between an adhesive polymer and the non-polar rubbers we must essentially rely on a primary chemical bridge; an actual chemical reaction at the interface must be produced.

There are a number of methods by which the polarity of the rubber (or any polymer material) can be approximated by means other than general solubility determinations. A number of investigators have used contact angle measurements (2) to indicate polarity characteristics. Contact angle investigations usually measure the degree of wetting between the polymer in question and a reference liquid.

The degree of adhesion between a polymer and a liquid that wets the polymer is usually higher than between the polymer and a liquid which it does not wet. Two materials of similar polarity will usually wet each other and demonstrate a low wetting angle when placed in contact; if they are identical, the angle, of course, is exactly zero. By measuring the wettability of rubbers against a reference liquid such as water or heptane, we can obtain some idea regarding the polymer polarity. A polar rubber usually shows a low wetting angle, when water is used as a reference agent, and a higher wetting angle if heptane is used as a liquid. A non-polar rubber or polymer, however, will show low wetting angles against heptane and high angles against water.

It can be shown that complete wetting, however, is usually not sufficient to give adequate adhesion. Ade-

quate wetting and a reasonable degree of polarity of the joined materials must characterize the system. Many polymeric adhesives may wet non-polar butadiene-styrene and natural rubbers, but the systems are still characterized by inadequate physical adhesion. If a polar rubber, however, is wet satisfactorily by a resin of similar polarity, the adhesion is usually quite apparent.

Experimentally, it is quite common to measure the wetting angle of both the rubber and a proposed adhesive against a reference liquid such as water. We frequently find that a polar resin, which has the same wetting angle against a reference liquid as the polar rubber does against the reference liquid, is usually a resin which has adhesion utility in the bonding of the rubber in question. As stated previously, however, resins which adequately wet non-polar rubbers are rarely capable of producing adequate physical adhesion to these non-polar materials.

In addition to good interface compatibility, suggested by good wetting, we must also have a sizable degree of electrical polarity existing in both the rubber and the adhesive polymer. In thermodynamic terms, we can state that the "interface tension" must be low, and the individual free surface energies of the separate rubber and adhesive polymer surfaces must be reasonably high. Good wetting is merely indicative of low interface tension, but does not by itself signify adequate total adhesion.

Mathematically we can express these general relations by the well-known Dupré equation (3) which expresses the thermodynamic work of adhesion as a function of the free surface energies (F_1 and F_2) of the two unjoined surfaces, and the free surface energy or interface tension F_I existing between two materials after they are bonded. For liquid systems the free surface energies are identical to the surface tension values; for solids, however, the free surface energies and the surface tensions are not absolutely identical (4) because some allowance must be made for the molecular immobility of the solid surface.

The simplified version of the Dupré equation may be given as

$$W_T = F_1 + F_2 - F_I.$$

We should emphasize that W_T is the thermodynamic work of adhesion, and the actual work expended in mechanically rupturing an adhesive interface will be many times the value of W_T. The actual work done in mechanically breaking an adhesive interface involves, in addition to interface phenomena, factors such as elastic and plastic deformation, etc. The value of W_T, however, as Scholberg and Hatfield (5) have so aptly stated, "is important out of proportion to its magnitude, for, if it did not exist, neither would the other (work) terms."

Some information is available that suggests that the actual mechanical works of adhesion among certain related systems may actually bear the same relations to each other as the respective thermodynamic work values (6). Details of the thermodynamic nature of interface phenomena are contained in a number of standard texts. An illustration of the Dupré equation is given in Figure 2.

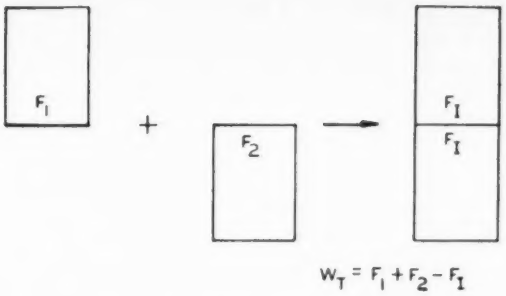

Fig. 2. Simplified Dupré equation

We may demonstrate the above principles governing polar adhesion by the following examples. An illustration of wetting angles of various magnitudes is shown in Figure 3. The rubbers, such as neoprene and butadiene-acrylonitrile, give low angles of wetting against a reference material such as water; the angles are usually somewhere between 20 and 50 degrees. Phenolic resins (such as Durez[3] phenolic 12987), a number of the vinyls, isocyanates, and a number of epoxy resins demonstrate similar low angles of wetting against water.

Natural and butadiene-styrene rubbers, however, demonstrate much higher wetting angles against a water reference. Butadiene styrene, coumarone indene, polystyrene, and polyethylene resins also demonstrate similar high wetting angles against water. The relatively polar resins such as the phenolics, epoxys, isocyanates, etc., show good wetting and frequently good adhesion against neoprene and butadiene-acrylonitrile rubbers. Such resins, however, neither wet nor adhere to butadiene-styrene or natural rubber materials. The non-polar resins will wet butadiene-styrene and natural rubbers, will not wet neoprene or butadiene-acrylonitrile rubbers, and give satisfactory adhesion to neither group. A chart showing the relative polarities of various resins and rubbers is given in Figure 4.

Effect of Compounding and Processing on Polarity of Base Rubber Polymer

The polarity of a compounded rubber may be influenced by factors other than the nature of the base

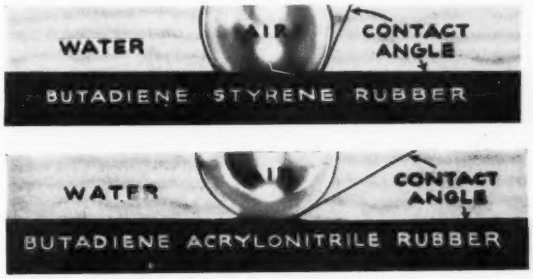

Fig. 3. Wetting angle for water on rubber surface. Top photo shows air bubble on butadiene-styrene rubber surface submerged under water with large water-rubber contact angle indicated. Lower photo shows small water-rubber contact angle for water on butadiene-acrylonitrile rubber surface

[3] Durez Plastics Division, Hooker Electrochemical Co., Niagara Falls, N. Y.

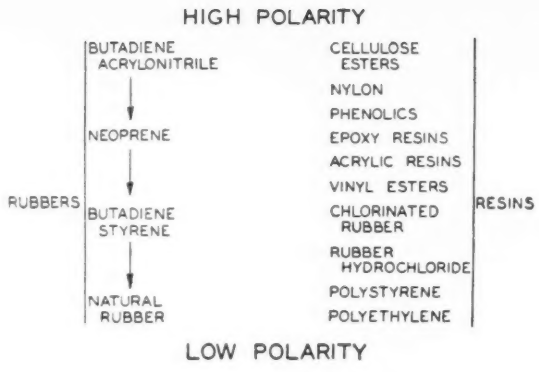

Fig. 4. Relative polarity of various resins and rubbers

elastomer. Mechanical milling of natural rubber under ordinary atmospheric conditions will usually increase the rubber's polarity. Many compounding agents radically change the polar nature of the rubber. Waxy aliphatic agents added to various natural rubbers for environmental resistance decrease the polarity abruptly and make the rubber extremely difficult to bond. Small traces of resins that are slightly more polar than natural rubber (coumarone-indene, abietic acid esters, etc.) will often increase the polarity of the rubber material slightly and produce satisfactory wetting between the natural rubber and adhesive polymers demonstrating intermediate polar characteristics.

Other methods of investigation show promise as means of establishing the polarity of rubber or other polymers. Triboelectric investigations (7) may allow a determination of polar tendencies by means of a measurement of the contact potential of the polymer. Materials of high dielectric constant (and high polarity) are usually positive when compared to a material of low dielectric constant and low polarity. This method of investigation has not, as yet, been exploited to any degree in the adhesion field.

Miscellaneous Characteristics of Rubber Materials Affecting Bondability

A number of other physical phenomena determine the ability of the rubber material to bond to a given adhesive. Surface roughness is one such factor which is of some importance in predicting the bondability of a rubber; we shall later see that this factor is of greater importance when one considers the characteristics of the adhesive polymer at the metal surface. A rubber may, when molded against a smooth surface, show the ability to conform to the surface. The examination of such a material with optical and electron microscopic techniques usually shows that the contour of the rubber is a mirror image of the surface against which the rubber has been cast or molded.

Such rubbers, when prepared in the absence of a confining surface, usually demonstrate an almost liquid-like smoothness against an air interface. Such conforming rubbers are usually easier to bond than rubbers which show extremely rough surface patterns and an inability to conform to an interface contour. Most natural rubber materials, for example, are extremely rough microscopically, and this factor may contribute to the difficulty sometimes encountered in the production of adhesion with such compounds.

Chemical Cross-Bridging of Non-Polar Rubbers

It was previously stated that production of adhesion to the polar rubbers, neoprene and butadiene-acrylonitrile, could be facilitated through the action of polar or secondary valence forces, and that adhesion to natural and butadiene-styrene rubbers usually demands the production of some primary chemical link between the rubber and the adhesive. In most instances the chemical cross-linking agent is sulfur, and the mechanism of cross-linking is probably similar to the mechanism operative during the vulcanization of rubber. The sulfur probably migrates to the interface, participates in a primary chemical bridging mechanism, and produces a chemical union between adhesive and rubber. The sulfur may initially be added to either the rubber or the adhesive (or both) and moves to the interface by either concentration migration or catephoretic effects.

Adequate wetting between a non-polar rubber and a non-polar adhesive may not, as described previously, produce good physical adhesion, but adequate wetting is, nevertheless, still important in these non-polar systems. Low interface tension assists materially in the enhancement of the primary cross-linking process. Good interface contact must exist before an effective interface chemical reaction can occur. For primary chemical adhesion, it usually suffices that low interface tension occurs; the total work of physical adhesion need not be high. We can see, therefore, that some of the factors that are significant in the production of polar adhesion to neoprene and butadiene-acrylonitrile rubbers are indirectly operative in the production of chemical adhesion to the natural and butadiene-styrene rubber materials.

Interface wettability also affects the interface reaction by affecting the sulfur diffusion rate across the boundary. Concentration migration of sulfur across the interface usually occurs when the concentration of sulfur in either the adhesive or rubber is higher than the concentration characterizing the adjoining phase.

Catephoretic migration of the sulfur occurs when the adhesive and the rubber differ sufficiently in polarity to produce an electrical potential at the interface. This potential may either assist or hinder the normal concentration migration, depending on the relative electrical charges existing in the sulfur-adhesive, sulfur-rubber, and adhesive-rubber contact potential systems. If the electrical interface phenomena assists normal sulfur migration, the effect is desirable. If the electrical interface potentials hinder the migration, the effect is undesirable.

Because it is extremely difficult to establish and control the directional effects of these contact voltages, it is usually desirable to reduce the potential between the rubber and the adhesive to as small an order of magnitude as possible. This reduction is usually accomplished by reducing the interface tension and increasing the interface wettability to the maximum possible degree. Admittedly, one may sacrifice some of the desirable effects of an interface contact voltage as far as the sulfur migration phenomena is concerned, but the advantages

of a low interfacial tension term in the overall adhesion picture more than compensate for this loss.

There are strong similarities between the sulfur interface bonding mechanisms and the normal mechanism involved in rubber vulcanization. The effect of vulcanization accelerators and modifiers is therefore of marked importance. The alpha-methylenic hydrogen in natural rubber is probably the site of most sulfur reactions (8), and the presence of a similar reactive point, an unsaturated bond, or an easily removable hydrogen atom, in the adhesive polymer chain, is undoubtedly necessary.

A number of rate processes must be considered in the establishment of a favorable chemical interface equilibrium and adequate cross-bridging for adhesion. These rate processes may be listed as follows:

1. A rate process involving the migration of sulfur across the interface to produce a satisfactory concentration of sulfur in both the adhesive and rubber phases.
2. A rate process characterizing the internal vulcanization of the rubber.
3. A rate process characterizing the internal cross-bridging or vulcanization of the adhesive. This cross-bridging may involve sulfur, or it may be a matter of internal polymerization.
4. A rate process governing the sulfur interface cross-bridging reaction between the rubber and the adhesive—the formation of adhesion.

If the internal vulcanization rate process in the rubber itself is extremely high, much of the sulfur and reactive chain positions in the rubber are used up before the proper sulfur migration can occur; the production of adhesion in such a system becomes very difficult. This point is particularly true if the rubber is the chief source of interface sulfur. If the rate process of internal rubber cross-bridging or vulcanization is low, and the rate process governing interface cross-bridging is high, favorable adhesion will probably result. If the rate process characterizing the interface cross-bridging mechanism is very low, however, adhesion will probably be difficult to produce under most conditions; there are two other competitive internal sulfur combination processes which will probably adsorb sulfur and accelerators and contribute little to adhesion production (see Figure 5).

The effects of rubber compounding ingredients on the degree of adhesion produced depend directly on the effects of the various additives on the four different kinetic processes (Figure 5) involved at or near the interface. We usually find that a rubber material high in sulfur concentration bonds more easily than a material possessing a low sulfur loading; the increased amount of sulfur migrating to the surface usually more than compensates for the increased internal vulcanization rate of the rubber itself. Accelerators usually have a variety of effects, depending upon the chemical nature of the material. Some accelerators may increase the rate of internal curing faster than they increase the rate of interface cross-bridging. These accelerators are, when added in sizable amounts, obviously not the most useful materials for use in rubbers that must be subsequently bonded.

An increase in carbon black loading in the rubber may either increase or decrease the bondability of said material, depending upon whether the black increases or decreases the rate of internal vulcanization. Acid blacks, which seem to retard rubber curing rates, are more agreeable to the establishment of bondability than are most alkaline agents. A plasticizer may increase the bondability of the rubber material through either the reduction of interface tension or through the decrease of rubber curing rate; coumarone-indene resins, for example, inhibit the internal rubber vulcanization and thus increase the probability of cross-bridging action.

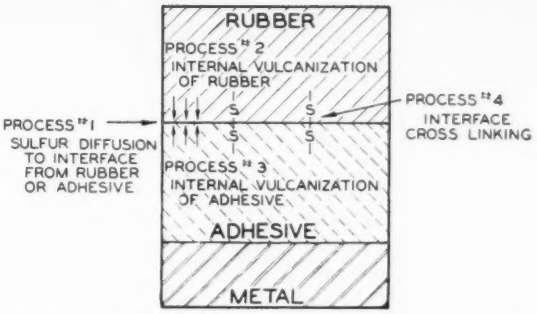

Fig. 5. Kinetic process operative during sulfur reaction at rubber-adhesive interface. Processes 2, 3, and 4 are competitive

The thermal stability of the rubber polymer to be bonded has a marked influence on the bondability of the material. If methylenic hydrogens, unsaturated bonds, or other reactive centers are normally not present in the polymer chain, the application of a high temperature may cause partial decomposition and produce some type of useful reactive site. We should not assume that sulfur is the only cross-bridging agent which may be utilized in the production of a primary chemical interface link. Other materials which are vulcanizing agents for rubber can also be used (peroxides, sulfur monochloride, etc.), but since these materials, when placed in the rubber, contribute little to the mechanical properties of the material, we shall not discuss their use at this time, but later mention their use as additives to the polymers that constitute the adhesive film. A diagram of the various rate processes mentioned in this section is given in Figure 5.

Structure and Nature of the Polymeric Adhesive

Polarity of Adhesive Polymers

The polarity factors previously discussed for rubber materials are also of importance when one considers the characteristics of polymeric adhesives that are conducive to adhesion. The polymeric material in the adhesive, however, in addition to demonstrating high adhesion and low interface tension between itself and the rubber, must also demonstrate adhesion to the metal surface. In the last section a number of resins reasonably polar in nature were mentioned, and it was stated that these resins often show adequate physical adhesion to neoprene and butadiene-acrylonitrile rubbers. A number of resins that wet, but do not give adequate adhesion to non-polar rubbers were also given.

Resins of low polarity will rarely give adequate physical adhesion to metal surfaces. Metals require, for ade-

quate physical adhesion, that the polymeric resins demonstrate a polarity which is reasonably high, but not excessive (the best physical adhesion between metals and polymers usually occurs when the polymer has a contact angle against water of between 25 and 35 degrees).

We might think that polymers with the strongest possible dipoles would demonstrate maximum adhesion to a metal surface. This is not the case, however, since very strongly polar polymer materials (such as cellulose acetate, etc.) are restricted in the dipole orientation of their polar molecular chains by the high existing internal fields within the polymer body. What we need for adequate metal adhesion, so far as polymer polarity is concerned, is a resin of a polarity that is high enough to allow metal-polar chain interaction, but low enough to prevent an inhibition of rotation within the polymer matrix itself; the absence of rotation would prohibit the production of a low interfacial free energy term in the Dupré equation.

The only rubbers that can be physically bonded with a single adhesive polymeric resin are the polar rubbers, neoprene and butadiene-acrylonitrile. When we attempt to utilize a resin which gives adequate wettability against the non-polar rubbers, we usually cannot obtain adhesion between the resin and the rubber (without chemical cross-linking) or physical adhesion to the metal surface. In the next section we shall discuss the possibility of chemical adhesion between the resin and the metal, but nothing will be mentioned regarding chemical effects at the metal surface at this time.

Chemical Cross-Bridging of Adhesive Polymer and Rubber

In the case of resins utilized as adhesives for non-polar rubbers the chemical reactivity factor in the resin chain becomes of paramount importance since the cross-bridging mechanism represents the chief process by which adhesion between the non-polar rubber and the polymer adhesive is obtained. The same reactivity qualities of importance in the rubber (alpha methylenic hydrogen, unsaturation, and thermally activated centers) are also of importance in the case of the adhesive polymer. The cross-bridging agent usually reacts in similar ways on both sides of the adhesive-rubber interface.

The addition of a cross-bridging agent and accelerators to produce adhesion between a non-polar rubber and the polymeric adhesive is usually most effectively accomplished by the addition of the cross-linking agent to the adhesive system rather than to the rubber, since the cross-bridging between adhesive and rubber can then occur with a minimum of effect upon the physical characteristics of the rubber itself. The addition of sulfur to adhesive systems is common, but more attention has lately been given to the utilization of materials such as nitrogen compounds, peroxides, etc., since these materials frequently react more rapidly with the reactive centers in the rubber and adhesive polymer than does sulfur.

Some adhesive materials have the potential of forming a primary chemical link to a rubber without involving the action of auxiliary cross-linking agents. Isocyanate monomers, or polymers containing free isocyanate groups, may react directly with active centers in a rubber chain. Isocyanates can react with active hydrogens, hydroxyl or mercaptan positions, acid radicals, and a variety of other chemical groups. The adequate adhesion produced between isocyanates and the polar rubbers may be the result of the action of both physical and chemical forces; the poor adhesion produced between isocyanates and the non-polar rubbers would indicate that any chemical bridging to these materials is still of a relatively low order.

Miscellaneous Characteristics of Adhesive Polymers Affecting Bondability

A number of other polymeric structural characteristics are of importance when one considers the nature of the adhesive polymers that are of relatively minor significance in the case of the rubber to be bonded. Surface roughness is such a property. A polymeric material, when allowed to solidify in air or aggregate by means of solvent evaporation, will assume a surface continuity which is dependent upon a number of factors such as molecular weight, solvent type, polymer polarity, impurities, chain symmetry, temperature, etc. Some polymers cast themselves into very smooth mirror-like surfaces and show no tendency to form rough mosaic patterns. Other materials, however, particularly those of high molecular weight and strong molecular rotational tendencies, demonstrate very rough surface topography. Such natural roughness is undesirable in any polymeric material that must conform to the continuity of a rigid metal surface. This roughness represents a tendency of the polymer to demonstrate poor liquid flow properties; hence, a polymer of this type may not completely fit itself to the surface geometry of the metal, and a reduction in contact area between adhesive and metal may occur.

Most highly elastic materials, even though they may have the proper polarity characteristics, rarely adhere to a metal surface by physical forces alone. An elastomeric material possesses too many of the characteristics of a kinetic gas and too few of the properties of a flowing liquid. One might argue that the addition of small amounts of an elastomer to a resin body will often increase the adhesion of that resin to a metal; butadiene-acrylonitrile rubber is often added to phenolic materials to improve the properties of a phenolic adhesive. The rubber, however, does not increase the specific adhesion between the phenolic and the metal; it merely decreases the amount of residual stress produced by the curing and the cooling of the resin. Generally speaking, high elasticity detracts from the adhesion of a polymer to a metal surface; this reduction in adhesion may be directly due to the gas-like characteristics of the molecular chains or indirectly to the mosaic roughness produced by the pronounced kinetic characteristics. These factors associated with high elasticity are of limited importance at the adhesive-rubber interface because of the non-rigid nature of the adhering rubber.

The molecular weight of the polymers may directly affect the adhesive characteristics of the material apart from the indirect effect of the molecular weight on the elastic tendencies discussed above. A monomeric liquid theoretically will give the best physical adhesion to a metal surface. The monomer is relatively small, rotates

easily, and demonstrates a relatively high heat of wetting. Monomers, of course, have no cohesive strength, and although the material may show good adhesion, it would have no structural stability. Materials of very high molecular weight, however, have excellent cohesive properties, but show limited rotation and, in general, a lower heat of wetting per unit weight of material. A molecular weight, therefore, for optimum adhesive properties, must be one that represents a compromise between adequate adhesional tendencies and cohesional performance. Vinyl acetate with a degree of polymerization of about 125 (molecular weight about 10,750), for example, is a satisfactory adhesive for metal surfaces; a polymer with either a larger or smaller chain length is less satisfactory.

The effect of molecular weight of the polymer in the adhesive on the production of chemical adhesion through a cross-linking mechanism at the rubber interface may also be pronounced. Generally speaking, the cross-bridging mechanism will take place through some type of free radical process and will generally act along the length of the polymer chain rather than at the ends; hence the chemical adhesion process is usually enhanced by high molecular weight fractions in the adhesive polymer material.

The molecular weight of the polymer in the adhesive may also affect the adhesion to the metal surface or rubber by affecting the homogeneity of the adhesive film structure. As molecular weights increase, most polymers, when deposited from a solvent, will show a marked increase in the non-homogeneity characterizing the polymer film. This increase in non-homogeneity is usually due to the differences in solubility of the various molecular weight fractions that usually increase in number as the average molecular weight of the polymer increases. Polymer films with a marked non-homogeneity display adhesion that differs from one area to another. A narrow molecular weight distribution is of value in decreasing this effect.

We can see that the molecular weight of an adhesive polymer or polymer mix is related in a complex fashion to the total adhesion, and some compromise between the various factors must be forthcoming.

Effect of Adhesive Solvent and Compounding Ingredients on Bondability

The solvent from which the adhesive film is applied can also affect the nature of the adhesion to either the metal surface or the surface of the rubber. Physical adhesion to either the metal surface or the rubber material will be directly affected by the polarity of the solvent; as solvents evaporate, they tend to rotate the end of the adhesive polymer toward the evaporation surface that is most like the solvent in polarity.

Toluene, for example, has a strong tendency to rotate the non-polar ends towards the surface of evaporation, and a ketone would tend to rotate the polar segments of the polymer toward itself as it left the film. It is obvious, if the rubber to be attached to the deposited film is polar,

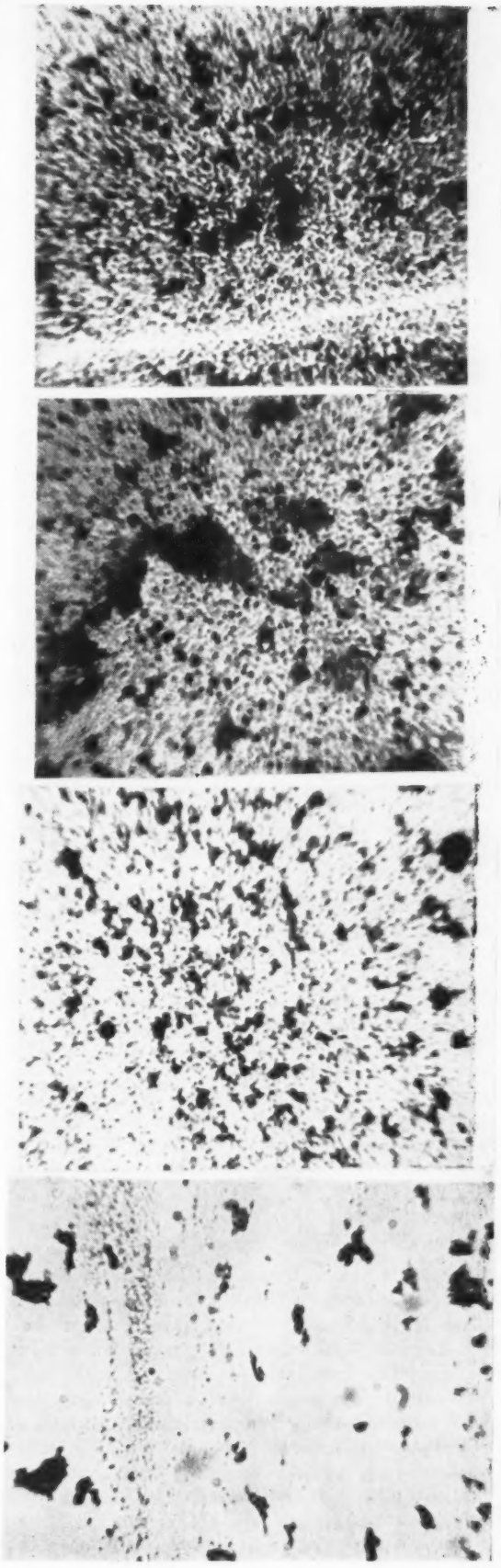

Fig. 6. Microphotographs showing typical non-homogeneity of commercial rubber metal adhesive film (magnification 2800 diameters)

that a ketone would represent a better solvent choice if physical adhesion is to be enhanced.

Chemical adhesion between the adhesive polymer and the rubber is similarly affected by the solvent type. Most chemical reactions between the rubber polymer and the adhesive polymer are characterized by free radical mechanisms. Such mechanisms are generally conducted in non-polar media; polar media interfere with these free radical mechanisms so common in rubber systems (8).

An explanation similar to that describing the effects of solvents on the free radical chemical mechanisms can also be utilized to explain the effect of carbon blacks in the adhesive. Carbon blacks that are alkaline (in either the adhesive or the rubber) enhance the free radical mechanism of any cross-linking or vulcanization process; while acidic carbon blacks have a negative effect. This carbon black effect is, of course, similar to that discussed earlier during the description of the effect of carbon black in the rubber on the interface acceleration and vulcanization procedure. The utility of the black again depends on its relative effects on the various kinetic interface processes.

Carbon black is often added to rubber-metal adhesive polymers in amounts considerably larger than that which can be justified on the basis of the simple control of chemical reaction rates within and between the adhesive and the rubber polymers. Carbon blacks, because of their tremendous surface area and surface reactivity, are often added to polymers to increase the specific adhesion between adhesive and rubber. Little is known about the possible direct reaction of carbon black and an adjoining polymer surface, but there is little doubt that the addition of large amounts of black to an adhesive polymer (sometimes as much as four parts of black to one part of adhesive polymer) greatly enhances the adhesion to many rubber systems.

We do not know whether this increased adhesion effect is due to an increase in the physical adhesion or the chemical adhesion of the system. Although these additions of large amounts of carbon black to an adhesive material may result in increased initial adhesion to the rubber, this common practice represents an undesirable trend in current formulation practice. Adhesives made in this manner are very difficult to maintain in a homogeneous state, and the films cast from such blends are usually extremely rough and possess pronounced mosaic relief. Photographic representation of films of a non-homogeneous commercial adhesive are shown in Figure 6.

Galvanic Effects—High Carbon Black Adhesives

The non-homogeneity, however, appears to be the least disagreeable of the objectionable effects of the high carbon black loadings. The manufacturers of such formulations have failed to realize that any system in which the carbon black concentration exceeds that of the polymer no longer possesses the electrical characteristics of a polymer material, and interfaces produced by the utilization of such an adhesive near a metal surface are characterized by galvanic potentials which definitely enhance bond destruction by galvanic current mechanisms operating in service.

The galvanic behavior of polymer-metal interfaces has been neglected by most adhesive technologists; few subjects are more important to the service life of articles manufactured with rubber-metal adhesive systems. An illustration of this galvanic effect is given in Figure 7; an equivalent electrical circuit is also shown.

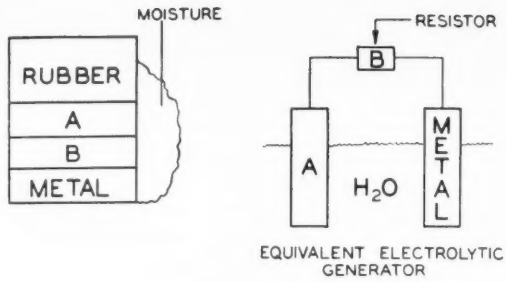

Fig. 7. Galvanic effects in adhesive bonds showing a conventional adhesive system with a highly loaded carbon black tie cement (A) applied over highly resistive primer (B). Voltages between (A) and metal often exceed one-half volt

Structure and Nature of the Metal Surface

Probably no topic in the entire adhesive field has received less attention than the effects of the structure of the metal surface on the adhesion produced between itself and the adhesive-polymer system. Failure of an adhesive bond is usually considered due to some inadequacy in the adhesive, and few attempts are usually made to modify the solid substrate to accommodate a given adhesive polymer; such is probably due to the relative ease, compared to a solid surface, with which a polymer blend can be altered. It is, however, ridiculous to omit consideration of the nature of the rigid surface to be bonded; we will mention a few variables that should be emphasized when one considers attaching a polymer surface to a metal.

Metal Types Utilized in Bonded Rubber Systems

Metals to which rubbers are usually bonded in practice may be classified as follows—ferritic (body centered cubic) iron alloys, austenitic (face centered cubic) iron alloys, aluminum and its alloys, and copper and its alloys.

Ferritic Iron Alloys. These alloys are usually free of any continuous oxide film that displays a definite independent structure; chemadsorbed gas impurities may, of course, be present.

Austenitic Steels. These steels represented by the 300 series stainless materials possess an oxide structure on the surface which is tightly adsorbed and relatively nonporous. The oxide layer is not an asset to physical adhesion because it "masks" the primary surface energy characteristics of the metal; chemical adhesion to such a surface can, however, sometimes be produced through a reaction with the oxide layer. Generally speaking, the austenitic ferrous alloys are more difficult to bond than the ferritic varieties because, as we have stated, the oxide

film inhibits physical adhesion between the polymer and the metal, and chemical adhesion to the oxide film may depend on specific conditions which are not always easy to provide.

Copper and Its Alloys. Copper alloys, like austenitic steels, are difficult to bond to a variety of polymers. The difficulty encountered with copper, however, is not due to the continuous oxide film present in austenitic steels, but to its tendency to form brittle, weak copper-amine compounds when heated in the presence of polymeric systems. Most polymers, of course, contain amines in the form of catalysts, cross-bridging agents, surface active agents, etc. Physical adhesion can be produced with many amine-free polymers, and chemical adhesion between a polymer and copper is not too difficult to promote. The conventional rubber-sulfur-brass bond is probably of primary chemical nature.

Aluminum and Its Alloys. The nature and the structure of the surfaces of aluminum and its alloys have been given more consideration by research workers in the field of adhesion than have the characteristics of other metallic materials. The microstructure of aluminum alloys has been the subject of extensive investigation (9) by the metal producer who desires to obtain the aluminum surface that will most readily adhere to decorative paints and lacquers and that will accept the penetration of a variety of organic dyes and pigments.

The energy characteristics of the base metal seem to be of minor importance in the case of aluminum alloys; the structure and porosity of the surface oxide appear to be most significant, and the importance of the base metal is primarily associated with its effect on the type of oxide layer that may be artificially produced by a variety of procedures. The oxide layer on aluminum alloys is presently subject to more modification and control than is the "masking" oxide on austenitic stainless. It is this ability of the technologist to manipulate the oxide on aluminum that has allowed more success in the attachment of polymers to aluminum than to passive stainless materials.

Aluminum alloys, such as 17ST and 24ST, compounded with various elements to increase their strength, have, because of these alloying elements, a mosaic pattern possessing numerous pores and holes; such voids provide an increased area for the operation of specific adhesion forces and also provide a mechanism for mechanical attachment. Alloys, such as 2S aluminum, with no pore structure, are much more difficult to bond.

Thermodynamic and Electrical Nature of Metal Surfaces

A number of general characteristics of metal surfaces should be given brief consideration. These general properties, however, in the case of a particular metal such as aluminum or copper, must be considered in view of certain specific properties discussed earlier.

The fundamental atomic structure of the metal has been given some consideration by a number of authors. Loughborough and Snyder (10) stated that the magnitude of adhesion of a variety of metals to a reference commercial adhesive was dependent upon the atomic spacing of the metal under consideration.

For the adhesive, with a measured identity period of 4.53Å, metals with lattice spacings in excess of 4Å gave the best adhesion; while metals with spacings less than this value were not adhered well. Such an observation is in agreement with our previous statement that the interface free energies between adhering phases be as low as possible; a "matching" of the micro-dimensional periodicities would contribute to a maximizing of the force of attraction and a minimizing of the interfacial free energy F_I.

A theoretical evaluation of those characteristics of a pure metal surface conducive to the formation of *physical* adhesion to a reference polymer can be made on the basis of either thermodynamic or electrical considerations. In general, the thermodynamics of the Dupré equation would suggest the desirability of a high value of the free surface energy of the metal. Comparing the free surface energies of various virgin solid metal surfaces is not a simple task. In general, however, we can expect that the relative magnitudes of the surface-free energies of solid metals are likely to be directly related to the relative magnitudes of the respective liquid materials. The surface-free energies of liquid metals are approximately inversely proportional to their atomic volumes (11). We might then expect that the free surface energies of metals would decrease in the following fashion—

Pt and Fe> Cu and Ag> Al> Zn and Cd> Na and K;

the metals that are conventionally considered as the high strength metals are apparently those possessing the highest free surface energies.

We can also evaluate the ability of a virgin metal to adhere to a polymeric agent by considering the electrical effects between the dipoles of a polymer and the surface of the metal. The negative pole of a molecular dipole usually seeks its positive mirror image in a metal surface, and the ability of the metal to associate strongly with the negative dipole of the polymer dictates the magnitude of the adhesion. A wave-mechanical interpretation of this problem predicts that, in general, the materials that display this electrical association ability to the highest degree are those metals that have the smallest atomic volumes (Pt, Fe, etc.). Whether the evaluation of virgin metal surfaces is of thermodynamic or electrical dipole origin, one must rate the metals with the smallest atomic volumes as those with the greatest potentiality for the production of physical adhesion.

One other factor should be considered. Skinner (12) recently suggested that electrons may actually flow from the metal into the polymer and that the resulting attraction between positive and negative charges is a factor in the adhesion between a polymer and a metal. Metals with low work functions would most likely participate in this type of electron exchange. The Skinner factor would probably therefore be most significant in the case of the soft, high atomic volume materials. The relative importance of this type of electrostatic interaction, which would rate the potential ability of metals to form high adhesion, with a polymer

system, in a manner that is the reverse function of the atomic volume to that characteristic of the electrical dipole interaction theory, has not been rigorously established.

Miscellaneous Characteristics of Metals Affecting Adhesion

Most metals, if they do not have some unique quality such as the thick porous oxide of some aluminum alloys or the objectionable amine forming tendencies of copper, at least possess a layer of adsorbed gases that mask, in part, the energy and electrical qualities described above. If the oxide is as continuous as that characterizing the austenitic stainless steels, it is possible to modify the film into a homogeneous layer with increased chemical reactivity. A controlled reduction in hydrogen or a treatment in a dilute alkaline bath will produce hydroxyl groups for subsequent condensation with a resin containing hydroxyl or amine centers; an oxygen bridge results. If the reduction of the metal is of an extreme nature, the metal may then have the qualities of the virgin crystal surface.

The surface area and the roughness factor of the metal are significant in many adhesive applications. When one is adhering two rigid solids, very rough surfaces may result in a "starved joint"; the peaks on the metal surface may actually "pierce" the adhesive layer and contact the adjacent surface; the total bond area is thereby reduced. In the case of rubber-to-metal adhesion no rigid, non-conforming surface opposes the metal, and starved joints are unlikely.

We can therefore assume, unless a surface is so rough that adequate spreading of the adhesive cannot occur, or unless the roughness produced some unfavorable stress distribution pattern, that a rough surface should be better for rubber-metal adhesion than a polished one. A rough surface will possess the larger actual area for the action of molecular forces. The actual excess of free area of a mechanically roughened surface is usually overestimated (13), but since roughening is usually accompanied by an increase in the free surface energy produced through working of the surface, a roughening process may also be useful from an energy standpoint.

Even an unworked rough crystal face possesses a higher surface energy property than a smooth one (14) of the same material. If any contour advantage favoring high values of the thermodynamic work of adhesion does exist, we must for rubber-metal adhesion assume, therefore, that it would favor the rough surface condition.

Modification of Metal Surfaces to Enhance Adhesion

Metallurgical manipulation of a surface to expose certain faces of a crystal pattern of a bulk material to the adhesive polymer is a subject that requires extensive investigation. Selective directional rolling with or without subsequent recrystallization and/or film removal are possible methods of increasing the work of adhesion. Crystal orientation with subsequent recrystallization will probably have little effect on the free energy of the metal surface since various faces of a metal crystal with similar roughness do not differ greatly in free energy value.

The interfacial free energy, however, which is a function of the relative nature of the two materials to be joined, may be affected by a crystal orientation operation. The selective wetting of various metallic crystal faces by organic constituents (15) is a manifestation of the uniquely distinct interfacial behavior of different crystal planes. The removal of any surface film will probably increase the surface free energy of the metal, and high surface free energy of a material to be adhered is in itself conducive to high adhesion.

Many chemical modifications of a metal surface are used industrially to render the surfaces more resistant to corrosive attack. Chromates, phosphates, and oxides are frequently used singularly or in combination with one another to produce anodic or inhibitive films. While some of these preparations are capable of producing surfaces that may improve the magnitude of physical or chemical adhesion to specific adhesives, they are not treatments that have the unique ability to provide a surface with enhanced "adhesiveness" for a wide variety of polymeric agents.

A number of attempts have been made to produce films, on metal surfaces, that display a high degree of electrical or chemical activity. Some of these films, particularly those that possess unsaturation or quatenary hydrogen centers, have an ability to increase the adhesion of aluminum and other metals to a wide variety of polymers. Such adhesion enhancement probably results from the existence of hydrogen bonding between film and polymer. Comparative tests, shown below, made with some of the typical ingredients of many rubber-metal adhesives, will indicate the relative adhesion of an aluminum surface cleaned by normal laboratory procedures and one that has been treated with a preparation producing a film with quatenary hydrogen centers. The resins were compounded to give breaks at the metal.

STRENGTH OF BOND

(Psi.—Metal to Metal Lap or Pounds per Inch—Rubber-to-Metal Peel)

	Epoxy	Polyester	Phenolic	Chlorinated Rubber
Aluminum				
(Cleaned)	1200 (L)	190 (L)	530 (L)	0 (P)
(Treated)	2980 (L)	1400 (L)	830 (L)	20 (P)

The first three of the above materials were tested for metal adhesion in a simple metal lap joint (L); the fourth was tested in an actual rubber-metal peel assembly (P). It is obvious from these above tests that a chemical modification of a metal surface can alter the bondability of a given metal to a marked degree.

Summarizing, we may state that any manipulation of the metal surface whch will allow high values of surface free energy, high values of attractive electrical interaction with the polymer, a low value of interfacial free energy, or the formation of a primary chemical link will enhance the utility of the metal in the formation of an adhesive bond.

Miscellaneous Rheological and Processing Variables Affecting Adhesion

Many concepts of general significance to any ad-

hesion problem will not be considered in this paper. The importance of such concepts as viscosity, temperature and pressure of application, tack, stress analysis, brittleness, etc. are treated in a number of general texts on adhesion fundamentals (16).

One factor, however, so often neglected in all types of adhesion practice is the relation between the coefficient of thermal expansion of the adhesive and that of the metal. A difference in these two coefficients, if the adhesive in question is cured at a different temperature than it is used, will produce thermal shear stresses along the metal-adhesive interface. Since most adhesives are relatively rigid materials, such stresses will not be eliminated by polymer relaxation and consequently remain as residual forces within a bonded assembly.

Reinhart has shown that such stresses reduce the ultimate applied load required to rupture an adhesive assembly and recommends the "matching" of the thermal expansion coefficients of the metal and the polymer. This matching of the expansion properties can be accomplished by adding various pigments, in fixed quantities, to the polymer adhesive. Reinhart has investigated in quantitative fashion the effects of various pigment materials in numerous classes of polymeric agents (12). By utilizing Reinhart's procedures, the formulator should have little difficulty in reducing the effects of thermal stresses in rubber-metal bonding preparations. Pigment additions are also useful in reducing the interface stresses produced by volume changes that accompany the curing of an adhesive agent.

Summary of Significant Factors

Factors of significance in the production of adhesion between rubber and metal can be divided into factors characterizing the rubber to be bonded; factors characterizing the adhesive polymer; and factors characterizing the metal.

For physical adhesion at the rubber-adhesive and adhesive-metal interfaces, it is important that the unjoined phases to be bonded demonstrate the maximum possible free surface energy compatible with a low interfacial free energy existent after bond formation. If adequate physical adhesion at either the rubber-adhesive or adhesive-metal interface is unlikely, chemical adhesion produced by the formation of primary valence bonds must be promoted. Neoprene and butadiene-acrylonitrile rubbers can be adhered by the physical forces alone; natural and butadiene-styrene types require the formation of primary chemical bonds.

The characteristics of a rubber that are significant in the production of adhesion are the polarity of the base polymer, the polarity changes in the rubber material induced by compounding or processing methods, the surface topography of the stock, the chemical reactivity of the rubber chains, and the nature of the interfacial electrical characteristics at the adhesive layer that influence the movement and reactions of chemical cross-bridging agents.

Factors related to the nature of the adhesive system that are of importance are polymer polarity, the chemical reactivity of the polymer chain, the nature of chemical cross-bridging additives, the surface topography, the elasto-plastic nature of the adhesive, the molecular weight of the adhesive polymer, the homogeneity of the adhesive film, the solvent present in the adhesive system, the nature, concentration, and galvanic activity of reinforcing pigments, and the thermal expansion coefficient of the bonding agent.

Qualities of a metal of importance in the adhesion picture are the thermodynamic free energy of the surface, the structure and thickness of natural or artificial adsorbed films, the crystal orientation and free energy change produced by mechanical rolling, and the surface roughness factor.

The Development of Adhesives of Improved Utility

Every manufacturer and user of adhesives for rubber-metal bonding desires to adhere the greatest number of rubber polymers with the minimum number of adhesive systems. One adhesive for all types of rubbers and metals would be a most desirable product, and although many manufacturers have claimed the development of such a preparation, no single adhesive available today will adequately handle all elastomers and give adequate adhesion to metal. Adhesive systems polar enough to give adequate adhesion at the metal interface and adequate strength with the polar rubbers simply do not wet the non-polar stocks to a sufficient degree.

Adhesive technology usually accommodates this dilemma by "plying" two or three adhesive preparations; the least polar of the "plys" is placed next to the non-polar rubber, and the most polar next to the metal. The discontinuity in wettability between metal and non-polar polymer is bridged in this fashion.

The chlorinated aliphatics such as rubber hydrochloride, chlorinated rubber, and associated derivatives probably display more flexibility in their adhesive performance with varieties of polar and non-polar rubbers than do any other conventional polymers. Such materials used alone or in mixtures with each other, or other agents, do display reasonably broad versatility. They are of medium polarity; so they wet all rubbers to some degree. They show low interface tension and moderate adhesion against a variety of metal surfaces, and they possess reactive centers to which cross-bridging agents, such as sulfur, can attach themselves.

The production of adhesives that will display marked strength and environmental resistance, however, will require a higher work of adhesion at the metal surface and greater cohesional durability than one can obtain with chlorinated aliphatics. Perhaps the most promising avenue for future adhesive development is the synthesis of completely different and unique polymers and cross-bridging agents especially designed for rubber-metal adhesion use.

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(*Continued on page 240*)

Production Runs Versus Small Orders In a Molded and Extruded Goods Plant[1]

By PIERCE SPERRY

Sperry Rubber & Plastics Co., Brookville, Ind.

Large differences have been found in the time required to set up certain pieces of production equipment and the time required for minimum, economical production runs in molded and extruded goods plants.

Original cost estimates for short production runs may be made more accurately if separate set-up, mixing, handling and finishing, etc. charges are developed for runs of various lengths. Also, more emphasis on enlisting customer cooperation so that orders will provide for minimum, economical production runs should be made.

THE only similarity between production runs and small orders in a rubber goods plant manufacturing molded and extruded parts is that both may be run on about the same equipment. Beyond this point the difference is very great, especially with respect to cost of production and its effect on the company's profit margin. Small orders require very careful consideration, and a detailed comparison of cost of manufacture and probable selling price between such orders and large production runs of the same or similar parts should be made before the order is accepted. Otherwise the manufacturer may find that he is faced with a loss rather than a profit as far as the small order is concerned.

Opinions on Minimum Runs

Large differences of opinion were found among the members of the committee on production runs *versus* small orders with regard to the minimum time to set up certain pieces of production equipment and the time required for minimum, economical production runs. These times varied between the limits shown in the accompanying table for certain production machines and for equipment used in the molded and extruded goods finishing departments.

Machine or Equipment	Set-Up Time Hrs.	Min. Economical Run, Hrs.
Tuber	0.3 to 2.0	0.6 to 4.0
Press		
Small, 24- to 32-inch platens	2.0	24 to 240
Large, automatic	8.0	420
Guillotine cutter	0.1 to 0.3	n.a.
Punch press, for refrigerator gaskets	1.0 to 4.5	n.a.
Small punch presses	0.6 to 2.0	n.a.
Vulcanizing molds and equipment, for refrigerator gaskets	0.6 to 4.0	n.a.
Butt-splice	0.5 to 3.0	n.a.
Bulk strips without opener	0.2 to 0.6	n.a.
Bulk strips with opener	0.4 to 1.5	n.a.

No figures were received from other members of the committee for minimum, economical runs for extruded or molded goods finishing, as indicated in the table. At Sperry Rubber & Plastics Co. we would consider that vulcanized refrigerator gaskets would have to run at least eight hours for economical operation; while a butt-spliced gasket would have to run four hours. It is recommended that a questionnaire be circulated among the members of the Molded & Extruded Subdivision of the RMA to obtain more figures on the time required by various companies to achieve minimum, economical runs in their molded and extruded goods finishing departments so that an average figure or figures for these operations under small-order conditions may be established.

Small Shipments from Fair-Sized Runs

A related problem is the customer whose order represents a fair-sized production run, but who requires delivery in small numbers over an extended period of time. Chardon Rubber Co. tries to handle this situation by first determining the smallest production run that can be made at a cost on which a reasonable selling price can be based. Then this company negotiates with the customer for authority to make production runs no smaller than the predetermined length. Chardon Rubber agrees to ship only the quantity the customer desires each month if he cannot or will not take the total production run at one time. The company carries the balance of the order in stock until it is required by the customer's schedule. Generally, the customer agrees to take any parts from the manufacturer's stock within a reasonable period of time or to pay for parts on hand at the end of an agreed-upon final shipping date, if the part is then obsolete.

Chardon Rubber reports, however, that it still has good customers who will insist occasionally that only

[1]Presented before the meeting of the Molded & Extruded Subdivision, Rubber Manufacturers Association, Hot Springs, Va., June 17, 1955. Other members of the RMA production *vs.* small-order committee were: R. B. Young, Acushnet Process Co.; C. L. Shreiner, Chardon Rubber Co.; R. C. Stein, Goodyear Tire & Rubber Co.; R. G. Bradley, Harris Products Co.; and C. E. Bellow, United States Rubber Co.

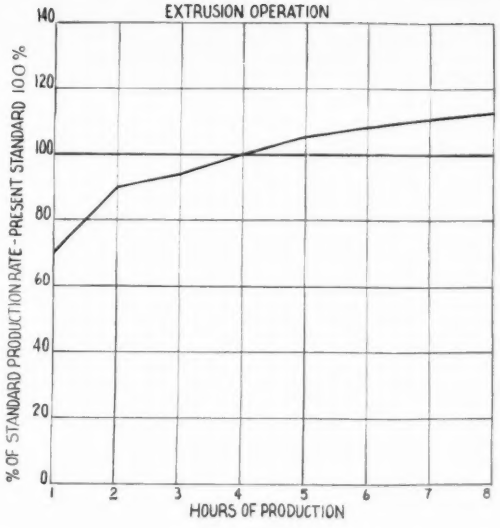

Fig. 1. Actual production rate compared with standards for eight-hour extrusion operation run

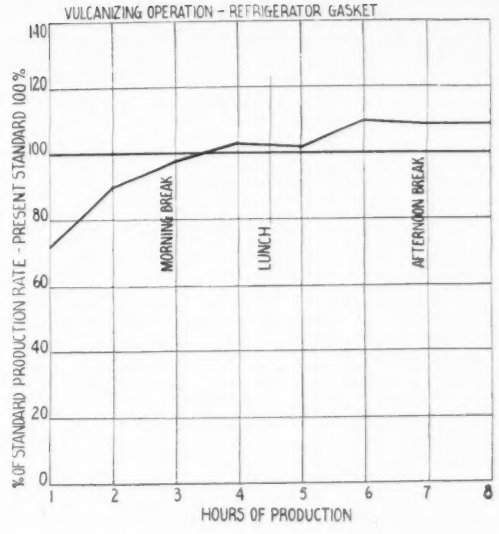

Fig. 2. Actual *versus* standard production rate for refrigerator gasket vulcanizing operation

one or two months' requirements of an order be manufactured at one time. The company then has to decide whether to run a larger amount and take the risk of the part becoming obsolete or to run the smaller number and absorb the higher production cost. The savings in costs, including setup time, labor, and scrap, to a company that can arrange for most of its small-order runs to be in the minimum, economical category are of such magnitude that a few higher-cost short runs and obsolescent parts can be tolerated. It is recommended that more manufacturers endeavor to sell their customers on the advantages to them of orders that will permit minimum, economical runs in the producing plants.

Small-Order Costs

In the survey made by the committee many ideas were presented as to methods of figuring small-order costs and means of insuring that all significant costs were included in the final estimate. Every manufacturer probably feels that he has calculated a fair cost for runs of this type, but it is the hope of the survey committee that some of the costs we will now describe may motivate many molded and extruded goods manufacturers to re-examine their cost calculations for small-order runs.

First, we would suggest that if the stock used is other than a standard stock, then the full cost of the Banbury or mill batch, or multiples thereof, should be charged to the small order or run. Some manufacturers add an additional laboratory or stock control cost since they have extra costs in these departments for running a special stock. There are also the extra costs in the compounding and mixing departments which should be calculated and included in short-run costs.

In the tubing department, costs for short runs should include the tube-machine head scrap and the set-up time or the time required to get the part running to size and at the proper speed for the various sizes of tubing machines and the different compounds involved. Additional special costs that should be taken into account since they affect tubing machine operation and the final cost of the product are the warm-up time, trimming time, and time for curing, which may be different and sometimes greater than for longer production runs. Also, parts cured on forms require delivery of the forms to the location where the part is placed on the form; then there is the operation of placing the form and the part in the proper curing pan or tray, and finally the forms must be returned to the stockroom or warehouse.

If the stock is prepared for molding by extrusion, most of the above-mentioned tubing machine costs are important to the calculation of manufacturing costs for molded products. Set-up costs in the molded goods department include the time required to get the mold or molds from storage, clean or otherwise prepare the molds for use, bolt or place the molds in the press, and warm up the molds sufficiently to make the item without excessive scrap losses. Generally, scrap losses are higher even under the best of conditions when a different compound and/or product is run for the first time. There is also the additional cost of taking the mold out of the press when the run is completed, preparing the mold for storage, and delivering it to the storage area. If the product uses a metal insert, there is the cost of obtaining the inserts from the warehouse and returning unused inserts.

In the finishing of both extruded and molded items the cost of getting the finishing operation started should be calculated. There are special trimming tools for use with molded goods and punching equipment and vulcanizing molds for use with extruded, punched or vulcanized parts, all of which require special and not easily standardized operations and may mean loss of production on other equipment carrying a high-unit manufacturing cost, including overhead. In special finishing operations, scrap losses are usually higher at the start of a run.

Not to be overlooked is the amount of the minimum service charge to be added to the cost of running small orders. A figure of $50 for such orders is mentioned

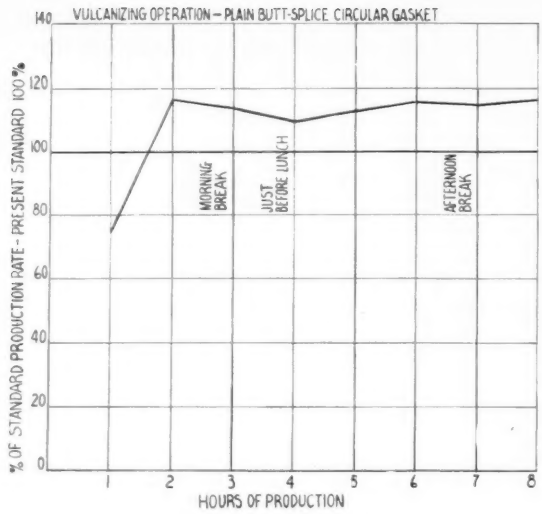

Fig. 3. Actual *versus* standard production rate for plain butt-splice circular gasket vulcanizing operation

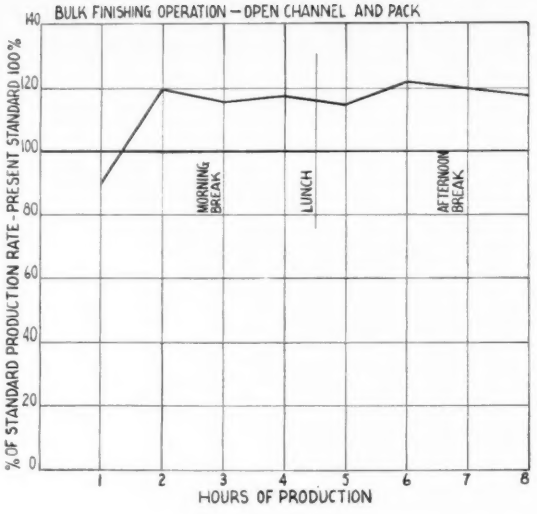

Fig. 4. Actual *versus* standard production rate for bulk finishing operation

most, and Sperry Rubber & Plastics uses such a figure. When I recall that the average sales value of production from each of our tubing machines is more than $100 per hour, even when all of the lost time on these machines for set-ups, short orders, sample runs, down time for die changes, etc., is taken into account, I am convinced that this $50 service charge for small orders is too low.

Actual vs. Standard Production Rates

In connection with my assignment on this committee I have had our time-study department review our production rates for several operations at various times of the day for the purpose of determining how correct and how well our standard rates were giving us a true picture of our costs.

Figure 1 shows that on an extrusion run of eight hours, we do not get our production equal to or above the standard rate until after about four hours. The results presented in this graph and the following graphs are not the results of just one or two runs, but are averages for several of our more or less regular production runs.

Figures 2, 3, and 4 present results from a time-study check on production in our finishing department, separated into three sub-classifications: refrigerator gasket vulcanizing, which could be the same for any difficult-to-vulcanize part; small miscellaneous part vulcanizing; and bulk finishing, where we have parts which are finished in straight lengths and where we have the operation of opening the channel.

In Figure 2 for refrigerator gasket vulcanizing, you will note that we do not reach our standard production rate until about 3½ hours after the day's production has begun.

In Figure 3, for vulcanizing on small items, a plain butt-splice circular gasket, for example, we achieve our standard production rate in about 1½ hours.

Figure 4 shows the time study-check on a bulk finishing operation, which was the type of job involving straight length parts where we had to open the channel and pack. It took about 1½ hours to reach the standard production rate. Admittedly, it looks as though the standard rate was too low since our employes are able to reach the standard rather quickly and produce at a rate well above standard for a considerable period of time. All of these figures, however, represent true time studies taken on quite a few runs and for several different production operations.

From all of this information it is obvious that we need to give more thought to our original cost estimates for short runs if we are to know with a greater degree of accuracy whether or not we are making a profit on our operations.

When charts such as Figure 2 show that it takes almost four hours to get our production running at the standard rate for a given operation, and when we realize all the special factors involved in obtaining the true cost for short-run orders, some of us may feel that we are not doing our estimating of costs for short-run orders very well.

New Short-Run Approach

In the near future Sperry Rubber & Plastics will estimate the cost of short runs by using higher rates for the first four hours of certain types of production and lower rates for the remainder of these runs, when such an approach seems justified.

Figure 5 is an example of what we now feel our future estimates will look like. This sample estimate is based on a standard refrigerator-door gasket, vulcanized with four right-angle corners, although the estimate could have been applicable to almost any extruded part which we produce. It will be noted from the total factory cost shown that we have applied the information gathered in the committee survey to estimate more accurately and at the same time show the difference between large- and small-volume production runs. You will see that the

Nº B 5

Extruded Cost for Sperry Rubber

To: OUR CUSTOMER
1 HOPE
U.S.A.
Att. of MR. John Buyer
Part No. 14U Inq. No 5/1/55
From: R. SALESMAN Date 5/1/55
~~For:~~
Comp. No. 7-SR.11 Sp. G. 1.30 Cost 18 Sched. 7/55
Weighby 1000 Lbs. Per M Pcs. ~~Ft. Lbs.~~
Length 10 ± 0" I. D. Wall
Type Die SINGLE HOLE Ft. Per Min.
Tuber. No. 3-A No. Workers 2
Cure on CHANNEL PANS Cut on PUNCH 1
Vulc. No. 7-B No. Molds 6 Cav. 1
Joints MITRE-90° Finish Pack. 25 TO CARTON
Prev. Est. No. A 711 Revised Est. No.
Date Est. R K 5/4 M H S/5-LBS/6 Posted 5/7/55

QUAN.	250		500		1000		2500-UP	
OPER	HRS.	COST	HRS.	COST	HRS.	COST	HRS.	COST
11	2.31	8.02	2.19	7.60	2.09	7.26	1.82	6.32
13	9.25	31.20	8.76	29.60	8.35	28.15	7.26	24.40
20	3.46	11.50	3.28	10.90	3.14	10.40	2.72	9.02
30	2.20	7.00	2.10	6.69	2.00	6.36	1.90	6.05
33	12.00	30.00	11.30	28.20	10.70	26.75	10.00	25.00
40	26.70	66.75	20.00	50.00	18.00	45.00	17.00	42.50
TOTAL		154.47		132.99		123.82		113.29

Material	Lbs.	Price	Extension
Stock 7-SR.11	1000	18	180.00

Total Fact. Lab. Burden Material

SET-UP CHARGE DATA

Operation	Hrs.	Rate	Total
Head Scrap	1 LB	21	.21
11	.4		1.39
13	.8		2.70
20	.6		1.99
30	.3		1.05
33	1.00		3.50
40	2.00		7.00
Total Set Up Charge			17.84

QUANTITY	250	500	1000	2500	5000	10000/265
Head Scrap			.42	.63	1.05	2.11
11			2.78	4.17	6.95	13.90
13			5.40	8.10	13.50	27.00
20			3.98	5.97	9.95	19.90
30			1.05	1.05	1.05	1.05
33			3.50	3.50	3.50	3.50
40			7.00	7.00	7.00	7.00
Total Set Up Charge	17.84	17.84	24.13	30.42	43.00	74.45
Converted Set Up Per M Pcs.	71.36	35.68	24.13	12.17	8.60	7.45
Total Factory Labor Burd. & Mat.	334.47	312.99	303.82	293.29	293.29	293.29
Class. ~~Mat'l~~ Non-Black E Mix .045-045-045-049.038 .026	45.00	45.00	45.00	43.00	38.00	36.00
Outside Purchased Material						
Total	450.83	393.67	372.95	348.46	339.89	336.74
Defective Loss 13% 10% 8% 7%	58.61	39.37	29.84	24.39	24.39	24.39
Total Factory Cost	509.44	433.04	402.79	372.85	364.28	361.13
Adm. Burden & Selling Exp. 14-13-12-11	71.32	56.30	48.33	41.01	41.01	41.01
Carton 40 - #25 @ 55 each -	22.00	22.00	22.00	22.00	22.00	22.00
Total Cost	602.76	511.34	473.12	435.86	427.29	424.14
Percent Profit						
Prices Quoted (Date)						
Revised Quot. (Date)						

Tool Charge Ext. Die Form Die Form Pcs. at Ech.
Punching Equip. Notch Cutting Vulc. Molds at

Apx. Tooling Time Apx. Dlvy
Special Data:-

Order Rec. Our Die No. Our Part No. Cust. No.

Nº B 5

Fig. 5. Sample estimate in which separate and variable costs for set-up, mixing, etc. have been used for orders of varying size

(Continued on page 240)

Evaluation of Silicone Rubber Modified with Teflon[1]

By WILLIAM H. CRANDELL

Frederick S. Bacon Laboratories, Watertown, Mass.

The addition of Teflon (polytetrafluoroethylene) to silicone rubbers in amounts up to 14 PHR improves tear resistance markedly with no decrease in the other physical properties. No improvement in resistance to swelling in various media over that of the unmodified silicone rubber compound was found. Teflon-filled compounds, however, show improved resistance over the control compound to oven aging at a temperature of 400° F.

More time is required to mix and process Teflon-filled silicone rubber compounds, and flow properties during molding limit size and shape of molded articles. Compression molded items show a certain degree of surface irregularity after oven post-cure but O-rings made from Teflon-filled silicone rubber have given satisfactory service for more than a year.

ALTHOUGH silicone rubber compounds are useful over the temperature range of —100 to +500° F.[2] and are resistant to many immersion media such as lubricating oils, dilute acids, and alkalies, they have poor resistance to aromatic, aliphatic, and chlorinated solvents.[3] In addition to the above shortcomings the silicone elastomers have notoriously poor tear resistance.

General Electric Co. published data in which it showed that the incorporation of small quantities of finely divided Teflon[4] in silicone rubber compounds increased the tear resistance two- to threefold and reduced the swell of the rubber in ASTM #1 oil at +300° F. from approximately 15% to approximately 1%.[5]

The purpose of the work covered by this paper was to determine the improvement in the tear strength and volume swell by incorporation of Teflon in typical commercially available silicone rubber compounds and to determine what effect this addition has on other physical properties such as tensile strength, hardness, compression set, and oven aging.

Incorporation of Teflon into Silicone Rubber

The Teflon used for the purpose of this investigation was Teflon Powder Grade 6 which has a particle size of 0.3-micron and is prepared from coagulated Teflon dispersion.[6]

The Teflon was incorporated into the silicone rubber using an Eemco[7] laboratory rubber mill having six-inch diameter, 12-inch long rolls. The roll speed was variable with a constant ratio of front roll speed to back roll speed of 1:1.4. Roll speeds given refer to the speed of the front roll.

One pound of silicone rubber, the maximum conveniently handled, was broken down into the plastic state by milling for approximately five minutes with a roll speed of 20 rpm. The roll speed was reduced to 10 rpm, and the Teflon powder added evenly to the rolling bank in the nip between the rolls.

After blending three times by rolling the stock up and passing through the mill endwise, the batch was sheeted off approximately ⅛-inch thick. At this point the Teflon was randomly dispersed throughout the stock in 1/64-inch diameter agglomerates approximately ¼-½-inch apart. The roll speed was increased to 30 rpm, and the distance between the rolls adjusted to give a sheet of stock approximately 0.003-inch thick on the back roll.

Small portions of the stock containing the Teflon agglomerates were added to the mill and milled for approximately 30 seconds. The size of these portions was such that only a very small rolling bank, 1/32-inch in diameter, was obtained. During the 30 seconds, the Teflon agglomerates were broken down and dispersed throughout the rubber. When the Teflon was completely dispersed, the rubber was scraped from the mill, and another portion added.

After all the agglomerates of Teflon were dispersed in the above manner, the roll speed was reduced to 20 rpm; the rolls were opened, and all the stock was added. When a continuous sheet was formed, the stock was mixed and blended.

No particular difficulty was encountered in the milling of the stock. The process, however, is time consuming. Using a six- by 12-inch laboratory mill, approximately three pounds of Teflon-filled silicone rubber can be processed in an eight-hour day.

After the complete dispersion of the Teflon, the stock can be stored. As with conventional silicone rubbers, the Teflon-filled compound should be broken down on the mill prior to molding. Usually, stock milled for 5-10 minutes in the morning is suitable for use during an eight-hour molding day.

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[1] Presented before the Division of Rubber Chemistry, ACS, Detroit, Mich., May 4, 1955.
[2] "Imagineering with Silicone Rubber," p. 4. General Electric Co., Waterford, N. Y.
[3] *Ibid.*, p. 7.
[4] Trade mark, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., for polytetrafluoroethylene.
[5] "G. E. Silicone Spotlight," p. 2, General Electric Co. (May 13, 1953).
[6] "Du Pont Teflon Tetrafluorothene Resin," p. 7, (1954).
[7] Erie Engine & Mfg. Co., Erie, Pa.

Preparation of Test Specimens

Slabs were prepared from the freshly milled rubber, using a chrome-plated slab mold. All stocks were press-cured for 10 minutes at 245° F. and 1,000 psi. pressure. The slabs were then oven-cured either 24 hours at 400° F. or 16 hours at 480° F. Tests were made on specimens, cut from the oven-cured slabs, using the following methods:

Tensile Strength, ASTM D412-41, Die C[8]
Elongation at Break, ASTM D412-41, Die C[8]
Hardness, Shore A-2, ASTM D676-47[8]
Compression Set at 300° F., ASTM D395-46T, Method B[8] (sample used was ¼-inch diameter by 0.080-inch thick)[8]
Tear, ASTM D624-48, DieB[8]
Oven Aging, ASTM D573-48[8]
Volume Swell, ASTM D472-49T (water displacement method)[8]

Effect of Teflon Concentration on Physical Properties of SE-550

The effect of varying the Teflon concentration on a typical commercially available low-temperature silicone rubber compound was evaluated. Silicone rubber compound SE-550 manufactured by G-E was selected as the base compound to which 0, 3½, seven, and 14 parts of Teflon 6 were added. Two cures, 24 hours at 400° F. and 16 hours at 480° F., were evaluated on these four compounds. The results of the testing are given in Tables 1 and 2 and Figure 1.

The data in Table 1 showing the properties of these compounds cured 24 hours at 400° F. indicate that the tensile strength of the SE-550 is greatly improved by the addition of Teflon, while the elongation of the stock is not significantly affected. The hardness of the base compound is increased by the addition of the Teflon, and the compression set resistance is slightly decreased. The tear strength is increased significantly as the Teflon content is increased. With 14 parts of Teflon, the tear value is approximately three times that of the base compound.

Table 1 also gives the results of testing the same base compound, SE-550, with varying Teflon content after an oven cure of 16 hours at 480° F. As in the case of the 24-hour cure at 400° F., the addition of the Teflon raises the tensile strength of the base stock with no significant effect on elongation. There is no significant change in compression set or hardness of the compound. As was the case with these same compounds when cured 24 hours at 400° F., the tear strength of the base compound is markedly improved with the addition of Teflon.

The tear strength of the Teflon-filled SE-550 compound *vs.* Teflon content is plotted in Figure 1. It is interesting to note that the tear strength of the Teflon-filled material is the same within experimental error whether a 24-hour cure at 400° F. or a 16-hour cure at 480° F. is used. Also from the trend of the curve, it is expected that even greater tear strength could be obtained using higher concentrations of Teflon than evaluated here.

Results of testing the Teflon-filled SE-550 compounds for swell in various immersion media are given

[8] "ASTM Standards on Rubber Products." American Society for Testing Materials, 1916 Race St., Philadelphia, Pa.

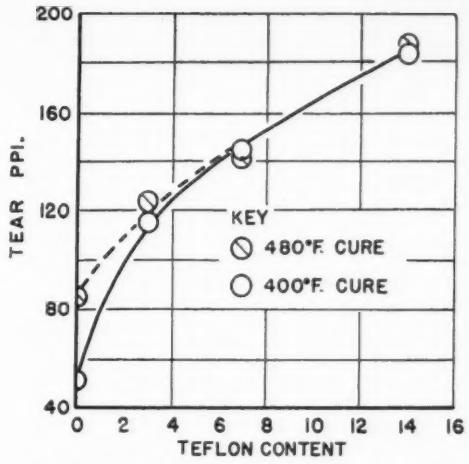

Fig. 1. Tear strength *vs.* Teflon content for silicone rubber compounds

TABLE 1. PHYSICAL PROPERTIES OF TEFLON-FILLED SE-550 SILICONE RUBBER

Teflon Content	Tensile, Psi.	Elong., %	Comp. Set	Shore Hardness	Tear Ppi.
24-Hour Cure at 400° F.					
0	670	230	28	46	54
3.5	926	300	36	65	116
7	900	280	36	69	145
14	900	235	36	66	184
16-Hour Cure at 480° F.					
0	830	235	31	60	86
3.5	808	260	35	60	124
7	893	250	39	67	141
14	995	225	36	62	185

TABLE 2. SWELL OF TEFLON-FILLED SE-550 SILICONE RUBBER

24-Hour Cure at 400° F.

Teflon Content	0	3.5	7	14
	Volume Swell—%			
Swelling Agent				
ASTM #1	11	10	9	8
3	86	78	74	55
DC 200 Silicone Oil*	36	36	38	34
ANO 6 Oil†	129	129	116	99
Aroclor‡	19	19	24	18
Isooctane	191	184	176	149
KM 70 Motor Oil§	6	7	8	6

* Dow Corning Corp.
† Air Force Specification Oil.
‡ Monsanto Chemical Co.
§ Koolmotor Corp.

TABLE 3. COMPOSITION OF SILICONE COMPOUNDS

Compound Ingredients	Improved Strength	Low Moisture	Low Compression Set
SE-76 Gum*	100	100	100
Santocel CS†	42	—	42
Cab-o-sil‡	—	35	—
Celite 270§	—	6	—
Super Floss§	—	—	6
Mercurous Oxide¶	—	—	0.6
Luperco Age‖	3.3	3.3	3.3

* General Electric Co.
† Monsanto Chemical Co.
‡ Godfrey L. Cabot, Inc.
§ Johns-Manville Corp.
¶ J. T. Baker Chemical Co.
‖ Lucidol Division, Wallace Tiernan, Inc.

in Table 2. These tests were run at 285° F. except for those materials which boil at temperatures lower than 285° F. In the latter case the compounds were immersed into the liquids boiling under reflux.

Slight decrease in swelling was observed with the higher loading of Teflon in ASTM #3 Oil, ANO6 Oil, and isooctane. There was no significant difference in the swell of the silicone rubber containing 3½ and seven parts of the Teflon in these fluids.

All the Teflon-filled SE-550 swelled approximately the same as the SE-550 control in ASTM #1 Oil, DC 200 Silicone Oil, Aroclor, and KM70 Motor Oil. Contrary to previous data published[9] there was no marked reduction in the swell of the Teflon-filled compounds over that of the base compound.

Effect of Teflon on Oven Aging of Silicone Rubber

Three compounds, given in Table 3, representing three important classes (improved strength, low moisture, and low compression set) of silicone rubber, were compounded with seven parts of Teflon 6. All the compounds were cured 24 hours at 400° F., then aged for seven days at 400° F.

TABLE 4. AGING OF TEFLON-FILLED SILICONE RUBBER COMPOUNDS

Compound*	Improved Strength		Low Moisture		Low Compression Set	
Teflon content	0	7	0	7	0	7
Physicals						
Tensile, psi.	740	840	805	865	520	580
Elong., %	270	280	280	285	215	200
Shore hardness	48	63	43	56	44	53
Tear, ppi.	62	126	46	64	43	132
Decrease in physicals after oven aging						
Tensile %	37	18	30	19	9	16
Elong., %	32	12	27	20	2	17
Duro. points	—6	2	—4	1	0	2
Tear, %	29	21	20	11	26	2

* See Table 3 for composition.

TABLE 5. PHYSICAL PROPERTIES OF TEFLON-FILLED SILASTIC

24 Hour Cure at 400° F.

Silastic	Teflon Content	Tensile, Psi.	Elong. %	Comp. Set	Shore Hardness	Tear, Ppi.
50	0	920	445	26	43	101
	7	824	400	24	60	145
8-164	0	805	375	40	49	87
	7	785	216	22	72	156
675	0	745	305	8	58	89
	7	1050	308	18	78	383
152	0	970	350	22	59	79
	7	706	292	37	72	121
7-171	0	600	115	16	64	55
	7	907	120	23	76	172
S-6088	0	460	120	66	67	38
	7	905	135	30	85	233
80	0	930	250	29	81	82
	7	1143	275	19	86	245

[9] "G. E. Silicone Spotlight," p. 2.

Table 4 gives the results of the physical tests on these compounds. In all cases the tensile strength of the Teflon-filled compound before aging is slightly improved over that of the base compound with no sacrifice in elongation. The Teflon-filled compounds are harder than the base compounds, as indicated by the Shore hardness readings. The tear strength of the Teflon-filled compounds in the improved strength class and the low compression set class is significantly improved; however, the tear strength of the low moisture compound is not significantly increased.

On aging seven days at 400° F. the Teflon-filled compounds of the improved strength class and the low moisture class show much less decrease in tensile strength and elongation than do the control samples. The Teflon-filled compound of the low compression set class shows a slightly greater decrease in tensile and elongation than the control. In all cases, however, the tear strength of the Teflon-filled compounds decreases less than that of the controls after aging, and a high level of tear resistance is still maintained in the filled compound.

Effect of Teflon on Physical Properties of Various Silicone Rubbers

Seven of Dow Corning's silicone rubbers of various types were selected for study. These silicone rubbers were compounded with seven parts of Teflon and cured for 24 hours at 400° F.

Physical properties of these compounds are given in Table 5. In every case the addition of Teflon increased the hardness of the silicone rubber in amounts ranging from five to 23 points. The compression set characteristics of Silastic 8-164, Silastic 80, and Silastic S-6088 were improved by addition of the Teflon, while in the other compounds the compression set of the filled compounds was slightly poorer. The elongation of all the compounds with the exception of Silastic 8-164 was relatively unaffected by the incorporation of Teflon. In the case of Silastic 8-164 the elongation was lower by 41%. Here again, however, marked improvement was noted in the tear strength of the Teflon-filled compounds tested; Silastic S-6088 showed almost a sixfold increase in tear strength, and Silastic 675 showed a fourfold increase in tear strength.

The tensile strength of many of the compounds tested was significantly improved by the addition of Teflon. For example, Silastic 675 having a tensile strength of 745 psi., when compounded with seven parts of Teflon had a tensile strength of 1050 psi., a 40% increase. Silastic S-6088, a silicone rubber for use in silicone oil has a tensile strength of only 460 psi. When Teflon is added the tensile is increased to 905 psi., a 96% increase. As shown in Table 5, the tensile strength of all the compounds is not improved. Silastic 50 and Silastic 152 show approximately a 15% decrease with the addition of the Teflon.

Effect of Grain Direction on Tear Strength

Because of the inherent fibrous nature of the Teflon-filled silicone rubber compounds the stock, as it comes from the rubber mill, has a definite structure running

the length of the sheeted stock. To determine if this grain has any effect on tear strength of the molded slabs, two sets of test specimens were cut, one parallel to the direction of grain, the other perpendicular to the direction of grain, from the slabs of four Teflon-filled compounds. The stocks tested were a Teflon-filled compound of the low moisture class mentioned earlier, Teflon-filled Silastic 50, Teflon-filled Silastic 675, and Teflon-filled Silastic 8-164.

TABLE 6. EFFECT OF GRAIN ON TEAR STRENGTH

Stock	Teflon Content	Tear, Ppi.	
		Cross Grain	With Grain
Low moisture*	7	88	80
Silastic 50†	7	145	128
675†	7	383	300
8-164†	7	160	156

* See Table 3 for composition
† Supplied by Dow Corning Corp.

The results of this tear testing are given in Table 6. These results show that the tear strength is only slightly less when tested with the grain, as compared to the strength across the grain. This finding indicates that the Teflon is sufficiently dispersed in a random manner throughout the compound to give adequate tear strength regardless of the direction tested.

Manufacture of Articles from Teflon-Filled Silicone Rubber Compounds

Teflon-filled silicone rubber, although greatly superior to ordinary silicone rubber in tear strength, presents some serious problems in the manufacture of molded articles. Ordinarily silicone rubber compounds are easily extruded and molded with no problems caused by nerve or lack of plasticity as long as the compound has been adequately milled beforehand. The Teflon-filled compounds, however, are very nervy and cannot be smoothly extruded even when freshly milled. Preforms cut from Teflon-filled compounds are very rough on the surface since it is impossible to sheet out the rubber so that it is smooth. Transfer molding of the Teflon-filled stock is not at all practicable because of poor knitting. The stock flowing into the mold from the transfer chamber does not knit well to itself; therefore an inferior product results that will delaminate when stressed.

Present molding techniques are limited to compression molding in a flash-type mold. O-rings are molded in these Laboratories by laying a piece of extruded uncured Teflon-filled compound of the desired diameter into the mold cavity in one-half the mold and overlapping the ends. (See Figure 2.)

The Teflon-filled compound is extruded previously through two 60-mesh stainless steel screens placed against each other and then through the extrusion nozzle, using a pressure of approximately 8,000 psi. Although the extrusion is very rough and knobby, the resultant O-ring after press-cure is smooth in appearance.

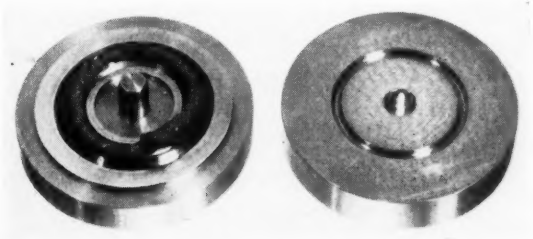

Fig. 2. Extruded Teflon-filled silicone rubber O-ring compound prior to compression molding

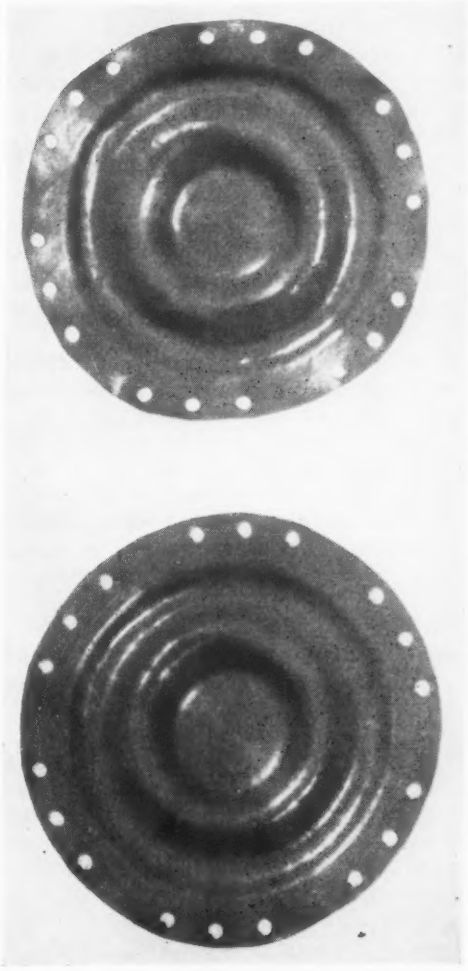

Fig. 3. Teflon-filled silicone rubber circular diaphragm, before curing, (bottom); after curing (top). Egg shape after curing due to plastic memory

After the ring is cured in an oven at 400 or 480° F., the surface of the ring is slightly irregular. On stretching of the ring, areas of high and low density are observed as knobby sections of the rings. This structure, which has been peculiar to all the Teflon-filled stock with which the writer has experimented, apparently does not affect the O-ring used in normal service since rings have been in service for more than a year without noticeable failure.

The molding of parts other than O-rings has been attempted. Deep drawn circular and rectangular diaphragms have been produced using the Teflon-filled compound. These are made by using either rectangular or circular preforms cut from the stock sheeted from the mill. The preform is cut so that it weighs approximately 10% more than the finished article and covers roughly two-thirds the plane area of the mold cavity.

Again, as in the case of the O-rings, the diaphragm, when molded, has a smooth appearance, yet, when cured, it is slightly rough. Also circular diaphragms, when cured 24 hours at 400° F., become egg-shaped. This condition is caused, it is thought, by the heat causing the Teflon to return to the structure in the as-milled condition (plastic memory). It may be possible to overcome this failing by press-molding the part at a temperature higher than the final cure temperature, but this has not been evaluated. (See Figure 3.)

Summary and Conclusions

Incorporation of Teflon into silicone rubber, although time consuming, produces a product having markedly improved tear resistance. The higher the loading of Teflon used, the greater the tear strength of the resultant rubber.

The addition of Teflon may or may not increase the tensile strength of the base silicone rubber, depending upon the compound used. In general, the hardness of Teflon-filled compounds cured at 400° F. is higher than that of the unfilled compound. When the compounds are cured at 480° F., there is negligible difference in the hardness of the filled and unfilled compounds.

The compression set characteristics of the base compound are usually unchanged or improved by the addition of Teflon. Incorporation of Teflon does not affect the elongation of the base compound.

Teflon-filled compounds show improved resistance over the unfilled base compounds to oven aging at 400° F.

Teflon-filled compounds do not exhibit significantly lower swell in immersion media than do the base silicone rubbers.

Parts can be successfully molded using conventional compression molding techniques; however, a certain degree of surface irregularity is noted after the conventional oven post-cure at 400-480° F.

Small Orders

(*Continued from page 235*)

set-up charges have been added to the direct labor charges and in accordance with the size of the proposed run, rather than used as a single fixed charge as part of general overhead. Advantage has been taken of the decreased unit charges for mixing and scrap losses for the larger runs so that the final total cost per 1,000 pieces for an order of 10,000 is $424.14, compared with $602.76 for an order of only 250.

It is our intention to use copies of Figure 5 at our sales meetings in order better to inform our salesmen and representatives of the true cost of some of these short runs and at the same time impress them with the importance of obtaining orders from our customers that will permit minimum, economical production runs, whenever possible. With this type of information we also hope to be able to prove to our customers the value to them of larger orders and longer runs.

It is the hope of the members of the committee on small orders *versus* production runs that we have provided some new information that will benefit the molded and extruded branch of the rubber industry.

Latex-Impregnated Gaskets

A gasketing material made of cork-base paper that is impregnated with Chemigum Latex has been developed for the oil and chemical processing industries by Garlock Packing Co., Palmyra, N. Y., according to The Goodyear Tire & Rubber Co., Akron, O., maker of the latex.

Called Garlock 662, the gasketing is said to be applicable to use in compressors, oil and water pumps, processing equipment found in the oil and chemical processing industries, and in automotive and other equipment used outdoors.

Use of the latex binder permits subjection of the gasketing to temperatures up to 300° F.; while ordinary vegetable fiber gasketing is not useful beyond 212° F., Goodyear explained. The latex is not susceptible to changes in moisture content, thus eliminating shrinkage, a critical problem in gasketing with glue binders. Garlock 662 sheets may, therefore, be stored.

Rubber-Metal Adhesion

(*Continued from page 231*)

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EDITORIAL

Too Little and Too Late for Natural in U.S.A?

WHEN the United States Government ended its control of natural rubber buying for our consumer industry in April, 1952, free competition began again for the first time in 10 years. In our May, 1952, issue in an editorial on this subject we quoted W. J. Sears, vice president of The Rubber Manufacturers Association, Inc., who said:

"The future success of natural rubber as a competitor rests on the ability of producers to develop a clean, uniform product, properly graded and packaged. Improvements in that direction are long overdue." (Ital. ours. ED.)

In another editorial in our November, 1952, issue we pointed out that when the government-owned synthetic rubber plants were sold to private industry, synthetic rubber would then really be sold and serviced in the same manner as other chemical products in this country, and we added:

"Either the producers abroad and/or their dealers in the United States will then have to provide the same kind of selling and service for natural rubber, or their volume of business will suffer materially." (Ital. ours. ED.)

At the ninth meeting of the International Rubber Study Group in Ottawa, Canada, May, 1952, the very poor quality of natural rubber from the Far East was emphasized by the United States delegation. American industry was now resuming private buying, and improved quality natural rubber was desired.

At a joint meeting of the crude rubber committees of the RMA and the Rubber Trade Association of New York held in January, 1953, it was agreed that an international meeting on rubber quality and packing should be held, but the first Rubber Quality and Packing Conference was not held until April, 1954.

At this meeting and a second such meeting held in New York in May, 1955, figures for degree of conformance with RMA standards for imports for the years 1951-1954 were revealed. In 1951, 41.6% did not conform to RMA standards; in 1952, 34.6%; in 1953, 30.1%; and in 1954, 29.3%. Although some improvement has been achieved, RMA standards are based almost entirely on visual inspection and not on scientific analysis. If specifications such as those used to provide "Technically Classified Rubber," since 1949 had been used, how much of the nearly 600,000 tons of natural rubber imported into the U.S.A. in '54 would have met such standards?

Questions raised by the U. S. delegation to the IRSG meeting in Ceylon in May, 1954, and a proposal made by the French Research Institute at the May, 1955, Quality and Packing Conference, that the RMA classification system be replaced by a technical classification system, resulted in an international meeting of producer and consumer technical men in London, England, during the week of October 4, 1955.

In August, synthetic rubber captured the largest segment of the American market since the Korean War. The B. F. Goodrich Co. and the Firestone Tire & Rubber Co. both recently announced the development of a synthetic rubber with the same unit structure as natural rubber, and the Goodrich company reports successful use of this rubber in truck and bus tires.

If established types of general-purpose and special synthetic rubbers have captured two-thirds of the American market and if a new synthetic rubber can replace natural rubber in truck and bus tires, is it not possible that current and future efforts of the natural rubber producing industry to hold one-third of the American new rubber market may be too little and too late?

R. G. Seaman

EDITOR

Meetings and Reports

Teflon and GR-S after Disposal at N. Y. Group

The New York Rubber Group meeting held at the Henry Hudson Hotel, New York, N. Y., October 7, heard R. H. Hardesty, E. I. du Pont de Nemours & Co., Inc., discuss "Teflon As an Engineering Material—How To Use It," and E. L. Borg, Naugatuck Chemical Division, United States Rubber Co., talk on the subject "Synthetic Rubber Today—Five Months after Disposal."

Besides C. V. Lundberg, of Bell Telephone Laboratories and chairman of the Group's educational committee, reported on the progress of lecture series on "Elastomer Technology," which began on October 3. Reports of other committees of the Group were also presented at the business meeting preceding the afternoon technical program.

Teflon

Teflon is a tetrafluorethylene resin and is supplied in the form of molding and extrusion powders and as an aqueous dispersion. Although conventional molding and extrusion techniques for thermoplastics are not applicable to Teflon because of its melt characteristics, it can be processed satisfactorily by using a cold-forming operation followed by sintering at temperatures of 720-740°F., it was said. The most widely used processing techniques are modified compression molding, ram extrusion through heated dies, extrusion of lubricated powder, and calendering.

It was emphasized that Teflon has an exceptionally broad service range of from —450 to +500° F. It is completely inert to nearly all chemicals and solvents, being affected only by molten alkali metals and fluorine gas under extreme conditions. Also, it has negligible water absorption and is unaffected by outdoor weathering. Electrical properties are excellent and remain so at high frequencies and high temperatures. Teflon has the lowest coefficient of friction of any solid in commercial use today.

Processors convert Teflon into such forms as sheets, rods, tubes, tape, and molded products. It can also be obtained in lacquers, enamels, and coated fabrics from the fabrics and finishes department of the du Pont company. The major uses of Teflon include high-temperature and high-frequency electrical insulation (motors, generators, transformers, television, radar, etc.) gaskets, packings, mechanical seals and linings and bearings in chemical equipment, non-adhesive surfaces for bakery rolls, and sealing plates and guides on packaging machinery.

GR-S after Disposal

In the five months since the purchase by private industry of the government-owned synthetic rubber plants, the consumption of new rubber in the United States reached an annual rate of 1.65 million tons during June, and consumption for 1955 is now expected to total close to 1.5 million tons, Dr. Borg said. This unprecedented usage, together with a high price for natural rubber, has resulted in a demand for GR-S type of synthetic rubber in excess of the total assigned capacity of the 12 copolymer plants recently sold by the government.

The available quantities of GR-S type synthetic rubber are being increased by purchase of additional government owned facilities, by operating the plants purchased in excess of assigned capacity, and by expansion of these same privately owned facilities. The supply of GR-S type synthetic rubber should exceed demand early in 1956, it was predicted.

The quality and uniformity of synthetic rubber under private operation is being held to the same high standards established over the 13-year period of government operation. Mention was made of the new subcommittee on synthetic elastomers of the American Society for Testing Materials and its work in preparing a system of nomenclature, classification, specifications, and test methods for synthetic elastomers that will be acceptable to both consumers and producers. No important changes have been made in the common grades of GR-S type rubbers, but the development of new and improved types will be stimulated by competition among producers, Dr. Borg concluded.

Group Technology Course

Enrollment in the course in Elastomer Technology totals 158, of whom 93 were members of the Group at the time of enrollment and 65 were non-members, Dr. Lundberg reported. Since the registration fee for non-members included the membership fee, they automatically became members of the Group.

Two registrants travel from Rome, N. Y.; one from Philadelphia, Pa.; one from Middletown, N. Y.; and 14 from Connecticut. Eighty-nine registrants come from north Jersey; five from Orange County, N. Y.; five from Trenton, N. J.; and 41 from New York City, Long Island, and Westchester. Eighty per cent of the registrants hold degrees consisting of 97 Bachelors, 20 Masters, and 6 Doctors. The type of work done, including some "double-duty" by those attending the course is as follows: 104, laboratory; 42, plant operations; 22, office affairs; and 31, sales. Time spent in the rubber business by the enrollees ranges from 33, one year or less; 36, two to five years; 40, six to ten years; 37, 11 to 20 years; 10, 21 to 30 years; and two in excess of 30 years.

The lectures are given on Monday evenings in the Engineering Societies Building, 29 W. 39th St., New York. The subjects covered and the speakers for past and future lectures are listed below:

1. October 3—Introduction to the Course, Dr. Lundberg.
   Natural Rubber, C. E. Rhines, U. S. Rubber.
2. October 10—Butadiene-Styrene Rubber, Dr. Borg.
3. October 17—Classes and Properties of Compounding Materials for Use in Elastomers, I. Drogin, United Carbon Co.
4. October 24—Compounding for Specific Effects and Measurement of Physical Properties, T. D. Bolt, Godfrey L. Cabot, Inc.
5. October 31—Reclaimed Rubber, J. M. Ball, Midwest Rubber Reclaiming Co.
   Butyl Rubber, R. L. Zapp, Esso Research & Engineering Co.
6. November 7—Nitrile Rubber and Acrylic Ester Copolymers, N. G. Duke, B. F. Goodrich Chemical Co.
   Silicone Rubber, J. J. Deasy, General Electric Co.
7. November 14—Neoprene and Hypalon, C. E. McCormack, du Pont.
8. November 28—Thiokol, J. S. Jorczak, Thiokol Chemical Corp.
   Isocyanates, R. R. Radcliff, du Pont.
9. December 5—Chemistry of Rubber Vulcanization and the Physics of Rubber, F. W. Boggs, U. S. Rubber.
10. December 12—Polymer Degradation, G. H. Hunt, Simplex Wire & Cable Co.
11. December 19—Polyethylene, R. J. Lurie, Bakelite Co.
12. January 9—Thermoplastic Elastomers—PVC Compounds, C. E. Schildknecht, Stevens Institute of Technology.
13. January 16—Latex, Sponge and Foam, G. G. Winspear, R. T. Vanderbilt Co.
14. January 23—Resins and Resins in Rubber, Speaker to be announced.
15. January 30—Rubber Processing Equipment, Plant Layout, Plant Problems, Speaker to be announced.

Committee Reports

At the business meeting preceding the afternoon technical session Group Chairman S. M. Martin, Jr., Thiokol, called for reports of certain committees.

G. H. Provost, U. S. Rubber, chairman of the golf outing committee reported on the 1955 golf outing and announced that the 1956 outing would probably be held in Westchester instead of New Jersey.

R. A. Emmett, Columbian Carbon Co., chairman of the nominating committee, reported the following nominations for officers and directors of the Group for 1956: chairman, Mr. Provost; vice chairman, H. J. Due, St. Joseph Lead Co.; secretary-treasurer, M. E. Lerner, *Rubber Age;* sergeant-at-arms, R. E. McElroy, Harwick Standard Chemical Co. Nominations for members of the executive committee for three-year terms were as follows: C. L.

Ayers, Borne-Scrymser Co.; C. F. Hoover, Pequanoc Rubber Co.; M. A. Minning, Witco Chemical Co.; and J. H. Fielding, Armstrong Rubber Co.

Dr. Martin reminded the Group at the dinner-meeting of the special party to be given on November 18, at the Henry Hudson Hotel, for B. B. Wilson, RUBBER WORLD, and Peter P. Pinto, *Rubber Age*, who are both retiring after serving on alternate years as secretary-treasurer since 1936. A cocktail party by the Group will precede the dinner, and short talks by past and present chairmen and an entertainment program will comprise this affair. Tickets at $6 each may be obtained from M. E. Lerner, *Rubber Age*, and R. G. Seaman, RUBBER WORLD.

Ritchey Talks on Rockets

Solid propellant rocket motors now in existence can today send a one-ounce object on a 237,000-mile trajectory to the moon. Harold W. Ritchey, technical director of the Redstone Division of Thiokol Chemical Corp., Trenton, N. J., told more than 200 scientists and engineers assembled at the September 15 dinner-meeting of the Thiokol Technical Club on the company's plant grounds.

Speaking on "Solid Propellant Rockets," Dr. Ritchey declared that such a flight can be achieved by a 1,000-pound four-stage rocket at a cost of $20,000. He expected, however, that currently used chemical fuels would give way to nuclear energy in the full-scale space travel of the future.

The solid propellant motor, one which literally burns itself out, enjoys greater advantages over liquid fuel rocket motors, which actually are chemical processing plants containing such equipment as storage tanks, valves, and meters that only add to the weight of the missile, Dr. Ritchey explained.

Thiokol is a manufacturer of solid propellant rocket motors for the United States Government.

Chemical Industry Exhibit

The Twenty-Fifth Exposition of Chemical Industries has been scheduled for the Commercial Museum & Convention Hall, Philadelphia, Pa., December 5-9. Purpose of the event is to acquaint chemists, engineers, and industrial management with the latest developments in the entire chemical field, including raw materials, processed chemicals, equipment, and research techniques, according to E. K. Stevens, president, International Exposition Co., organizer of the Exposition.

More than 500 exhibitors will cover the gamut of chemical production from the laboratory and drafting room, through the pilot plant, to final commercial manufacture. Admission of visitors will be by invitation. The general public will be excluded. Further details may be obtained from the International Exposition Co., 480 Lexington Ave., New York 17, N. Y.

Fourth Annual Wire and Cable Symposium Program

The fourth annual symposium entitled, "Technical Progress in Communication Wires and Cables," sponsored jointly by the Signal Corps Engineering Laboratories, Fort Monmouth, N. J., and the wire and cable industry, will be held at the Berkeley-Carteret Hotel, Asbury Park, N. J., December 6-8.

Details on the conference may be obtained from H. L. Kitts, chairman, or H. F. X. Kingsley, committee member, by writing to Signal Corps Headquarters or telephoning Eatontown 3-1000, extensions 51565 or 51564.

The program for this symposium has been received and is listed below. The 1954 meeting was attended by 562 people, representing 183 commercial companies and 17 government agencies.

Registration will begin at 4:00 p.m. on December 5 at the Berkeley-Carteret Hotel.

Symposium Program

Tuesday Morning—December 6
Chairman, H. L. Kitts, Chief, Outside Plant Branch, SCEL

9:30 a.m. **Welcoming Address,** Col. Earl F. Cook, SCEL.

An Introduction to the Technical Sessions, H. L. Kitts.

Ultra Accelerators in CV Vulcanization, L. A. Brooks, J. L. Tronson, and A. C. Rowley, R. T. Vanderbilt Co.

Physical, Mechanical, Chemical, and Electrical Properties of Marlex Ethylene Polymers, R. V. Jones, P. J. Boeke, and W. R. Clark, Phillips Chemical Co.

Improved Polyvinyl Chloride Insulation for 105 C. Service, B. W. Hodges, J. L. Foster, and H. L. Wuerth, B. F. Goodrich Chemical Co.

Tuesday Afternoon—December 6
Chairman, M. Tenzer, Chief, Microwave Transmission Lines Unit, SCEL

1:30 p.m. **Obtaining Mobilization Preparedness for Signal Corps Wire and Cable,** A. G. Christiansen, Signal Corps Supply Agency.

Progress in Air Dielectric Cables, E. J. Merrell, A. L. McKean, and J. Arbuthnott, Jr., Habirshaw Cable & Wire Division, Phelps Dodge Copper Products Corp.

The Electrical and Mechanical Characteristics of the Helical Membrane Cable, R. C. Mildner and R. J. Slaughter, The Telegraph Construction & Maintenance Co., Ltd., London, England.

Military Applications of Silicone Rubber Insulated Wire and Cable, J. F. Dexter, Dow Corning Corp.

RF Power Ratings of Teflon Coaxial Cables, G. J. Mares and C. C. Camillo, American Phenolic Corp.

Recent Progress in Magnet Wire Enamels, H. L. Saums and W. W. Pendleton, Anaconda Wire & Cable Co.

6:00 p.m. **Hospitality Hour.**

Wednesday Morning—December 7
Chairman, W. R. Krueger, Chief, Line Facilities Section, SCEL

9:00 a.m. **Transmission Characteristics of Rural Distribution Wire at Audio and Carrier Frequencies,** J. A. Brazes, Whitney Blake Co.

Rural Wire and Urban Wire for Telephone Distribution Systems, A. P. Jahn, Bell Telephone Laboratories.

Polyethylene Insulated Telephone Cable, A. S. Windeler, Bell Telephone Laboratories.

Protection Problems of Distribution Cable Systems, J. W. Phelps, Bell Labs.

A User's View of Plastic Insulated Conductors in Outside Telephone Plant, R. Foulkrod, Michigan Bell Telephone Co. A panel discussion with Mr. Foulkrod as moderator, and W. M. Alexander, L. M. Dahl, and J. R. Kershaw, all of Michigan Bell, as panelists.

Wednesday Afternoon—December 7
Chairman, H. F. X. Kingsley, Chief, Field Wire & Cable Section, SCEL

1:30 p.m. **Measurement of the Volume Resistivity of Plasticized Polyvinyl Chloride,** C. E. Balmer and R. F. Conyne, Rohm & Haas Co.

The Spiral Multicolored PVC Jumper and Switchboard Wire, G. deSenarclens, Swiss Insulating Works, Ltd., Breitenbach, Switzerland.

Crosstalk on Carrier Cables, K. E. Latimer, Submarine Cables, Ltd., London.

Recent Developments in Polyethylene Insulating Materials, R. J. Larie and J. A. Snyder, Bakelite Co.

New Use of Vinyl in Cable Construction, M. W. Williams, Monsanto Chemical Co.

9:00 p.m. **Banquet,** Invited Honored Guest, Major General James D. O'Connell, Chief Signal Officer.

Thursday Morning—December 8
Chairman, H. G. Gold, Chief, Special Cable Section, SCEL

9:00 a.m. **General Properties of the New Super-Polyethylenes,** G. H. Sollenberger, Koppers Co., Inc.

New Developments in Insulation Extrusion, A. N. Gray, Western Electric Co.

Developments in Submarine Communication Cables, J. J. Gilbert, Simplex Wire & Cable Co.

Development of Weather Resistant Vinyl Jackets, E. E. Griesser and W. T. Higgins, Bakelite Co.

Emission Microscopy Symposium

Emission microscopy will be the subject of a symposium to be held at the offices of North American Philips Co., Inc., research and control instruments division, Mount Vernon, N. Y., November 21 and 22. G. Baas, who collaborated with G. W. Rathenau in the design and development of the new Philips emission microscope, will be present to explain and demonstrate the instrument.

Researchers and technicians desiring to attend should write the company at 750 South Fulton Ave., Mount Vernon, N. Y.

Detroit Group Has Program on Radiation

Speakers at the October 7 meeting of the Detroit Rubber & Plastics Group held at the Detroit Leland Hotel, Detroit, Mich., were David S. Ballantine, Brookhaven National Laboratory, Brookhaven, N. Y., who discussed "The Use of Radiation in the High Polymer Field," and Henry J. Gomberg, University of Michigan Phoenix Memorial Laboratory, Ann Arbor, Mich. Approximately 150 members and guests attended the meeting, which was preceded by a cocktail hour.

Polymer Radiation Effects

Radiation in the form of gamma or beta rays from unstable radioisotopes or X-rays and high-speed electrons from high-voltage machines have been employed in the recent past for the study of polymeric systems, Dr. Ballantine said. These radiations have been successful in initiating polymerizations of the vinyl addition type and in the second-stage treatment of fabricated plastics and elastomers. There is no evidence that radiation can cause polymerization of a monomer when more conventional free radical catalysts will not.

Unique advantages derived from radiation polymerization because no impurities are introduced include polymerizations initiated at low temperatures and pressures; solid state polymerizations are possible; and radicals can be formed at low temperatures and "stored" for long periods, for later use at higher temperatures.

Radiation effects on polymers can be interpreted in terms of chain scission or cross-linking of chains, and the direction of the effect is largely dependent on the chemical structure of the polymer, the presence of fillers and oxygen. Polymers containing aromatic groups and mineral fillers show great resistance to attack; while polymers containing no hydrogen on the alpha carbon atom undergo rapid degradation. Most of the studies have been conducted from an engineering point of view, concerned with the suitability of polymeric materials under conditions of radiation exposure. There is much need of additional studies with a more fundamental approach, the speaker added.

In conclusion, it was pointed out that black and graft-type copolymers be formed by irradiation of one polymer in the presence of another. For example, by subjecting a polyethylene bottle containing styrene to radiation, it has been possible to graft up to 50% polystyrene on to the polyethylene chains.

Phoenix-Memorial Project

Dr. Gomberg's talk was on the subject of "The Applications and Implications of the Peacetime Uses of Atomic Energy." He described the general objectives of the Michigan Memorial-Phoenix Project at the University of Michigan, which included the erection in honor of students, alumni, and faculty of the University who lost their lives in World War II, a tangible memorial in which could be housed, in part, at least, the continuing program of research into peacetime uses of atomic energy.

The Phoenix Memorial Laboratory, recently completed, will include research on such projects as trichinosis, radiation control of combustion processes, and study of reactions by the new radioactive-tracer techniques.

Detroit Educational Program

For the sixth consecutive semester, an introductory course in rubber technology is being sponsored jointly by Wayne University and the Detroit Group. The course designed for beginning compounders, technical salesmen, etc., is given by S. R. Schaffer, United States Rubber Co., with the aid of a number of guest speakers. The program includes two field trips, one to the Chrysler Engineering Rubber Laboratory and the other to Baldwin Rubber Co. and U. S. Rubber, to observe large-scale processing.

Forty-five men from 16 different companies have registered for the course, some of the men traveling distances from 60 to 90 miles each way to attend the lectures. A part of the $30 tuition charge will be used to equip a rubber laboratory at Wayne University, which should be ready in time for the February, 1956, semester. In addition, a more advanced course in rubber technology will again be offered at that time.

Subjects to be covered in the current course include natural rubber, synthetic rubber, reclaimed rubber, compounding, physical testing, processing, vulcanization, special-purpose rubbers, latex technology, cements, design of experiments, and the chemistry of rubber.

Group Outing Reports

Ontario Group Tees Off

The Ontario Rubber Section's annual golf tournament was held at Dundas Golf & Country Club, Dundas, Ont., Canada, September 16, with 114 members and guests participating. Low gross was achieved by W. A. Pursell, Dunlop Canada, Ltd. R. A. Simpson, Gordon Dockrill, Ltd.; C. Pavanaugh, B. F. Goodrich Chemical Co., Ltd.; and Leo Schmalz, Dominion Rubber Co., Ltd., followed with second, third, and fourth low gross, respectively.

Harold Deline, Dunlop Canada, was low net for the day, and M. McKinsey, R. E. Ferguson & Co., was second lowest net. High score honors were garnered by B. Bejode, Gutta Percha & Rubber, Ltd.

Arrangements for the tournament were under the direction of C. M. Croakman, Columbian Carbon (Canada), Ltd. W. J. Nichol, Dunlop, presiding at the dinner, introduced the incoming chairman of the organization, W. H. Bechtel, Kaufman Rubber, Ltd.

Chicago Group Golfs

The Chicago Rubber Group's annual golf outing, held July 22 at St. Andrew's Country Club, West Chicago, Ill., was attended by 375 members and guests. More than $4,500 worth of golf and door prizes were distributed. Ralph Anschuetz, Witco Chemical Co., was chairman of the arrangement committee, and John Groot, Dryden Rubber Division of Sheller Mfg. Co., was assistant chairman.

Connecticut Group Outing

About 160 members and guests attended the Connecticut Rubber Group's tenth annual outing, held at Grassy Hill Park, Derby, Conn., September 17. The day's athletic activities, consisting of softball, horseshoe pitching, golf, and egg throwing, were concluded by the distribution of prizes; a portion of the prize money went toward relief for flood victims in the towns of Ansonia, Seymour, and Naugatuck.

James Boyle, Armstrong Rubber Co., was chairman of the arrangement committee, and R. L. Stotz, United States Rubber Co., was vice chairman.

Fisher Addresses Tlargi

"Development of New Synthetic Polymers" was the subject of an address given by Harry L. Fisher, professor of rubber technology at the University of Southern California, at the October 4 dinner-meeting of The Los Angeles Rubber Group, Inc., at the Hotel Statler, Los Angeles, Calif.

Dr. Fisher pointed out that many synthetic polymers far surpassed natural rubber in one or more such properties as heat, ozone, flame, and tear resistance; resistance to swelling in oils; hysteresis; color retention; and permeability to air. Samples of polymers exhibiting these superiorities were shown and discussed, and the future of the synthetic polymer field was said to be very bright.

Twelve door prizes donated by Tlargi were distributed by R. L. Wells, The Firestone Tire & Rubber Co. Red Sanders, football coach at UCLA, was the after-dinner speaker; 300 heard him.

SORG Fall Meeting

The use of rubber, plastics, and other polymers in modern military aircraft was discussed by Lt. Malcolm J. Rogers, Wright-Patterson Air Force Base, before 97 members and guests of the Southern Ohio Rubber Group at the Engineers Club, Dayton, O., September 22. How these materials withstood the effects of atomic radiation was also described, with photographs and exposed aircraft parts used as illustration.

A motion picture, showing most of the new types of experimental aircraft employed in military aviation, such as pursuit and fighter planes, bombers, trainers, helicopters, personnel carriers, and freighters, concluded the technical session.

Speakers at the business session included James R. Wall, Inland Mfg. Division, General Motors Corp.; Frank Newton and Robert Treue, Dayton Rubber Co.; and Earle R. Bartholomew, WP-AFB.

Two Talk on Carbon Black at Boston Group Meeting

Carbon black was the subject of two talks given before the Boston Rubber Group's October 14 technical session at the Somerset Hotel, Boston, Mass. The speakers, both with Columbian Carbon Co., New York, N. Y., were Carl W. Sweitzer, director of research and development, who discussed "Research Trends in Carbon Black," and Lloyd D. Treleaven, technical service engineer, whose topic was "Some Functional Aspects of Carbon Black." Edwin D. Covell, Stedfast Rubber Co., the Group's chairman, presided.

Dr. Sweitzer began by pointing out that all phases of carbon black technology are under continuing and intensive investigation to meet the changing demands of the rubber industry. Also, such standard properties as particle size, surface area, and size distribution have had to be reinvestigated in connection with the new oil blacks.

The greatest interest today lies in the identification and evaluation of the functional groups, as well as active sites, on the carbon black surface that are directly involved in the rubber-carbon interaction or bond, Dr. Sweitzer continued. Evidence points to the importance of such surface characteristics as the peripheral crystallite pattern within the carbon particle, as well as certain oxygen-containing terminal groups such as the quinones. Better carbon blacks for rubber reinforcement seem to lie in this direction.

Dr. Sweitzer outlined other current investigatory approaches, such as toward an understanding of the carbon-rubber interaction through physical and chemical testing, through the thermodynamic evaluations of Mullins and Parkinson, and through studies on carbon gel as related to mixing temperature and oxidation now being carried on by researchers in America, Australia, and elsewhere.

Mr. Treleaven first reviewed such basic concepts concerning carbon black as surface chemistry, particle size and structure, and the colloidal properties of carbon gel, before treating his main topic, the performance of carbon blacks in elastomeric compounds.

Mechanical goods compounders are confronted daily with the problem of meeting continually changing demands of compounding called for by automotive, ASTM, SAE, and military specifications, he said. They are also concerned with such associated problems as curing, processing, extrusion, mixing, and calendering.

In recognition of the fact that the industry itself was contributing to its own difficulties by producing a wide variety of carbon blacks, simplified data were developed which presented the effects of the rubber grades of carbon black over a full range of loadings on such properties as Mooney viscosity, Mooney scorch, extrusion performance, extrusion swell, and electrical conductivity and resistivity, as well as actual physical development such as tensile, elongation, modulus, and rebound.

Mr. Treleaven used slides to demonstrate these carbon black properties in Neoprene GN-A and GR-S 1500 type rubber, which he called two of the prime elastomers for mechanical rubber goods. He concluded by urging mechanical rubber goods compounders to acquire a basic knowledge of the properties of carbon black as a sure means of designing compounds which would process better and help meet the ever-demanding requirements of customers.

Following dinner, at which 300 were present, a short business meeting was held. Alan Bryant, Columbian Carbon, chairman of the Group's education committee, discussed the progress of the rubber technology course being given at Northeastern University under the organization's sponsorship. He also revealed that an advanced course would be given during the spring semester by B. B. S. T. Boonstra, of Godfrey L. Cabot, Inc.

Baseball's "Birdie" Tebbetts, manager of the Cincinnati Reds, the after-dinner speaker, related anecdotes of his career as player and manager in both leagues.

Adhesion Theories Before Ontario Rubber Section

"The Principles of Adhesion in Relation to Practice" was the subject of an address by Derik W. Sear, Dunlop Rubber Co., Ltd., England, before the Ontario Rubber Section, Chemical Institute of Canada, at the Pickfair Restaurant, Toronto, Ont., October 11.

The establishment of an adhesive bond between surfaces depends upon the utilization of the forces of attraction which exist between atoms and molecules and which can also act at an interface between an adherend and adhesive to give specific adhesion, the British researcher pointed out. This principle was seen to be distinct from mechanical interlocking which occurs when the adhesive is able to penetrate the surface of a porous adherend.

An ideal adhesive must be fluid to allow maximum interaction with the adherend surface, which must be free of interfering contaminants, and the so-called angle of contact should be less than 90 degrees, in which case the adhesive molecules show a greater attraction for the surface than for each other. In an angle of contact greater than 90 degrees the adhesive tends to form droplets and a discontinuous film, which is a serious source of weakness.

Mr. Sear concluded by stating that a final essential for the attainment of good adhesive bonds is that during setting up stresses are not formed within the joint which would tend to lower the bond strength.

The meeting was presided over by W. H. Bechtel, Kaufman Rubber Co., Ltd., and chairman of the Section. J. A. Carr, Dunlop Research Centre, and F. R. Gorrie, Cabot Carbon of Canada, Ltd., respectively, introduced and thanked the speaker.

Gamma Ray Vulcanization of Rubber

A paper entitled "Vulcanization of Rubber by Gamma Rays," by S. D. Gehman and I. Auerbach, Goodyear Tire & Rubber Co., was presented at the Annual Forum on Commercial and International Developments in Atomic Energy held at the Sheraton-Park Hotel, Washington, D. C., September 27-29.

It was pointed out that the vulcanization of rubber is an important, highly developed industrial process, the essential feature of which is a chemical cross-linking of the rubber molecules. Gamma rays cross-link rubber by the same mechanisms as occur on irradiation of plastics such as polyethylene, but not with as good efficiency. Carbon-carbon bonds are formed which are more stable than the usual sulfur bonds. Vulcanizing chemicals and sulfur have only small effect on gamma ray vulcanization, but fillers enhance the effects of radiation. The tensile strengths developed with a series of fillers were found to be related to the specific volumes of the fillers. Tensile strengths obtained with gamma ray vulcanization were not so high as can be secured by conventional vulcanization.

In addition, the radiation dose required for vulcanization was relatively high, 1 to 5 times x 10^7 rep. If this dose were delivered without heat losses, the rubber would reach ordinary vulcanizing temperatures. Typical potential advantages of the gamma ray vulcanization include uniform vulcanization of thick articles, more stable, better aging vulcanizates, cold vulcanization of extruded shapes or preforms, and faster preliminary processing of the rubber stock, it was said. The development of industrial applications of gamma ray vulcanization may be tied in with the economical utilization of fission waste products and developments in the technology of working with intense radiations, it was concluded.

SAE Gets Birthday Scroll

A scroll commemorating the fiftieth anniversary of the Society of Automotive Engineers was awarded the organization at the sixteenth anniversary dinner of Automobile Old Timers in the Waldorf Astoria Hotel, New York, N. Y., October 28. SAE president, C. G. A. Rosen, accepted the citation on behalf of the Society.

Service citations were also awarded to Postmaster General Arthur E. Summerfield; L. L. Colbert, president, Chrysler Corp.; Paul Garrett, vice president, General Motors Corp.; Pyke Johnson, past president, Automotive Safety Foundation; F. C. Crawford, chairman of the board, Thompson Products, Inc.; and Mrs. Mary D. Allen, accredited as being the nation's first woman automobile dealer.

C. F. Kettering, General Motors Corp., was guest of honor and principal speaker.

Fort Wayne Group Hears Burck on Polyurethanes

The Fort Wayne Rubber & Plastics Group, meeting at the Van Orman Hotel, Fort Wayne, Ind., September 29, heard Richard C. Burck, Mobay Chemical Co., discuss the chemistry and applications of polyurethanes. Attendance was 155.

Proper selection of isocyanates and polyesters and other reaction controls makes it possible to lengthen the polyester chain and cross-link the molecules to give flexible or rigid foam, elastomers, coatings, and adhesives with exceptional chemical, solvent, heat, and abrasion resistance, Mr. Burck said.

Coating isocyanates include Mondur C and CA, which are two-component systems with a work life of 12 to 48 hours, and curable at room temperature; and Mondur S, which provides a completely stable coating with unlimited work life at room temperature. Above 140° C. the isocyanate reacts, and desired film properties are obtainable.

These coatings, though new to this country, Mr. Burck declared, possess excellent heat-, abrasion-, chemical-, solvent-, moisture-, and general corrosion-resistant properties. Unpigmented coatings retain their full gloss on outdoor exposure; while pigmented coatings do not. The first commercial coatings application in the United States has been on magnet wire to provide excellent dielectric properties and moisture resistance combined with easy solderability.

Discussing urethane foams, Mr. Burck said they could be made in continuous blocks or molded in place, in flexible or rigid form, in densities varying from one to 30 pounds per cubic foot and in almost any cell size.

Urethane-based adhesives are partially reacted polyesters cured with isocyanate adducts and are available for flock printing and for bonding leather, rubber, and most non-metallic products to themselves or to each other, Mr. Burck concluded.

Newly elected officers of the Group for the 1955-56 term include Jack L. Carlson, Paranite Wire & Cable Co., chairman; M. J. O'Connor, O'Connor & Co., vice chairman; and John Dixon, Jr., Anaconda Wire & Cable Co., secretary-treasurer. The directors consist of Harold Anderson, General Tire & Rubber Co.; Tom Pollard, Monsanto Chemical Co.; Don Sprott, Auburn Rubber Co.; G. R. Gonyer, Farrel-Birmingham Co.; Reed Williams, Dryden Rubber Division; and M. E. Jones, Marbon Chemical Division.

CALENDAR OF COMING EVENTS

November 17
Connecticut Rubber Group.

November 18
New York Rubber Group. Pinto-Wilson Party. Henry Hudson Hotel, New York, N. Y.

December 1
Fort Wayne Rubber & Plastics Group. Van Orman Hotel, Fort Wayne, Ind.
Rhode Island Rubber Club. Pawtucket Country Club, Pawtucket, R. I.

December 5-9
Twenty-Fifth Exposition of Chemical Industries. Commercial Museum & Convention Hall, Philadelphia, Pa.

December 6-8
Fourth Annual Symposium on "Technical Progress in Communications Wires and Cables." Berkeley-Carteret Hotel, Asbury Park, N. J.

December 9
New York Rubber Group. Christmas Party. Henry Hudson Hotel, New York, N. Y.
Buffalo Rubber Group. Christmas Party. Buffalo Trap & Field Club, Buffalo, N. Y.
Detroit Rubber & Plastics Group, Inc. Christmas Party. Sheraton-Cadillac Hotel, Detroit, Mich.

December 10
Southern Ohio Rubber Group. Christmas Party. Miami Valley Golf Club.

December 10-17
Atomic Exposition. Cleveland Public Auditorium, Cleveland, O.

December 12-16
Nuclear Engineering & Science Congress. Cleveland, O.

December 16
Boston Rubber Group. Christmas Party. Somerset Hotel, Boston, Mass.
Chicago Rubber Group. Christmas Party.

January 17
Elastomer & Plastics Group, Northeastern Section, ACS. "Specialty Latex Applications."

January 23-26
Seventh Annual Plant Maintenance & Engineering Show. Philadelphia, Pa.

January 27
Akron Rubber Group. Mayflower Hotel, Akron, O.

February 7
The Los Angeles Rubber Group, Inc. Hotel Statler, Los Angeles, Calif.

February 9
Fort Wayne Rubber & Plastics Group. Van Orman Hotel, Fort Wayne, Ind.

February 17
Chicago Rubber Group. Furniture Club, Chicago, Ill.

George Oenslager

Apologies to Drs. Oenslager and Geer

In our September issue, page 746, we ran a picture captioned, "George Oenslager, Goodyear Medalist of the Rubber Division, ACS, and one of the early industrial rubber research chemists."

Unfortunately, the photograph used was that of another early industrial research chemist, W. C. Geer, instead of Dr. Oenslager.

Dr. Oenslager's photo is presented herewith, and we are sorry this error occurred.

Northeastern Section Hears Carver Talk on Far East

"The Far East of 1955" was the title of a talk given by Leslie D. Carver, export technical sales manager, Witco Chemical Co., before 70 members and guests of the Elastomer & Plastics Group, Northeastern Section, ACS, at the Museum of Science, Boston, Mass., October 18. Mr. Carver visited rubber companies in Japan, the Philippines, Australia, and New Zealand during a 23,000-mile trip last spring.

Japan, laboring under the handicap of a shortage of technical equipment, secures her rubber on barter from Indonesia in exchange for cotton goods, the Witco executive said. Much of Japan's carbon black is made from anthracene oil, but 13,322,000 pounds of American blacks were imported in 1954. Finished goods, such as hose, belting, tires, and tubes, are not always of top quality.

Australia, on the other hand, was seen to have large and progressive rubber factories, with such advanced items as tubeless tires now available. More than 34 million pounds of carbon black were imported from the United States in 1954.

New Zealand, too, was thought to have a well-run, if small, rubber industry.

Everywhere Mr. Carver found an urgent demand for American GR-S type rubber, but only such countries as Australia and

(*Continued on page 304*)

NEWS of the MONTH

Washington Report and National News Summary

. . . Communique from International Rubber Study Group meeting held in Liberia, October 17-21, emphasized production of new rubber will exceed consumption in 1955 by only 35,000 long tons, but additional capacity will be available to meet future increased demand. Increased research effort will be required with natural rubber, and technical service to customers should be initiated and maintained.

. . . Special Commission on Rubber Research of National Science Foundation held second meeting, October 24, in Washington, D. C. Widespread interest in use of Akron Government Laboratory on contract basis by industry reported. Two reports to be made to Congress on rubber research early in 1956, one by the NSF panel, and the other by the President in connection with the synthetic plant disposal program.

. . . Negotiations with six bidders for the Institute, W. Va., GR-S copolymer plant began October 8 and will be completed on or before December 21. This plant will probably be in production by private industry during the first half of 1956.

. . . U. S. Supreme Court agreed to review the government's anti-trust suit against E. I. du Pont de Nemours & Co., Inc.

. . . Industry leaders emphasize the need of more synthetic rubber production-capacity. Several new expansion projects announced.

. . . Commerce Department reaffirms that new production, rubber consumption, and sales volume records will be set by rubber industry in 1955.

. . . Wage increases granted rubber industry workers by General Tire, U. S. Rubber, and Seiberling.

Washington Report

By ARTHUR J. KRAFT

IRSG Emphasizes Tight Statistical Position; Urges More Research and Technical Service for Natural Rubber

The need of more research on rubber was underscored last month by the International Rubber Study Group, which held its twelth annual meeting at Monrovia, Liberia, October 17-21. In a far-ranging official communique, at the conclusion of the meeting, the Study Group urged a stepped-up volume of research activity and also dealt with several more conventionally commercial aspects of world rubber trade.

Here's a summary of the communique that came out of the deliberations of the 16-nation conference:

Statistical Situation

World output of natural and synthetic rubber will exceed consumption in 1955 by a slim margin of 35,000 long tons, equal to a little more than 1% of production. Natural rubber production was estimated at 1,850,000 tons, and consumption at 1,860,000 tons. Production of synthetics was forecast at 1,065,000 tons, and consumption at 1,020,000 tons. The estimates for synthetics exclude rubber produced by Soviet bloc countries. The communique noted that the 35,000-ton statistical surplus "will be available for absorption into stocks."

As for the long-term, the Study Group found that "for future years substantial additional potential capacity for the production of rubber would be available to meet demand." The communique remained silent on whether, and to what extent, natural rubber will contribute to the expected growth in supply.

Research and Development

"The Group agreed," the communique said, "that the work concerning rubbers for special uses, graft polymers and otherwise modified natural and synthetic rubbers, was one of the most promising lines of research and development from the standpoint of potential large-scale application. Therefore, it noted with satisfaction that work of this nature was being conducted at various research institutes and suggested that the volume thereof be augmented and the studies intensified.

"The Group emphasized again the importance of: (1) continuing work on the development of planting material combining a high level of disease resistance with a high yield and (2) continuing international cooperation in the exchange of improved planting material between the research centers and rubber growing countries of the world."

With this strong endorsement in hand, rubber products manufacturers here are likely to feel more encouraged about pressing for continued government support of the Latin American rubber research program.

Both the improvement of planting material and development of disease-resistant, high-yielding rubber trees are major objectives of this Latin American rubber research program. It is now being conducted with support of the International Cooperation Administration, but on a curtailed basis and with no assurance that funds

will be provided beyond the close of the current fiscal year, next June 30. Broad goal of the program is to create a stronger natural rubber producing industry in the Western Hemisphere. The Laboratory and field station have been resorted to in order to improve the yield of native Latin American trees which nature has endowed with sturdy defenses against leaf blight disease.

Much progress, but no final solution, has been attained in recent years through a cooperative undertaking by United States Department of Agriculture scientists and a number of Latin American governments. The program, shunted from one federal agency to another for financial support, is now under the none-too-receptive wing of ICA, latest of the "Marshall Plan" agencies.

Making Natural Rubber More Salable

"The Group was pleased to note that, in accordance with the recommendations made at its eleventh meeting in Colombo, a conference had been held in London from October 4th to 6th, 1955, between representatives of the rubber manufacturing industries in the United States of America, the United Kingdom, France, the Federal Republic of Germany, Italy, and The Netherlands, and the chief executives of the research institutes financed by producers."

The communique divulged nothing of what happened at that meeting, which was sought by producer interests in response to a straight-from-the-shoulder warning at Colombo last May that natural rubber producers must actively woo consumers if they expect to hold their market against the surging advances of synthetic rubber.

The warning was issued in a paper read at the Ceylon meeting by the American delegation, entitled "Natural Rubber at the Crossroads." It criticized planters for not moving fast enough in replacing obsolescent acreage with newer, high-yielding stock. Such action, the U. S. paper held, was necessary to keep natural rubber production costs down and to provide the expanded output needed to meet future increases in world demand.

That was a mere warm-up. The U. S. delegation, whose paper was read by W. E. Cake, United States Rubber Co. vice president, struck home with a warning that a major overhaul and speed-up in research by producer groups were needed to keep natural rubber competitive.

Producers, the U. S. group charged, haven't bestirred themselves enough toward improving their material—their research efforts toward making better rubbers for consumers have been sadly neglected. The U. S. delegates said they would welcome any move by producers to improve their consumer relations, but producers would have to initiate the move.

The hint was broad enough, and natural rubber research groups of a half-dozen nations, with two British groups in the lead, set up the London conference last month. Consumer delegates attended from the U. S., the U. K., France, Holland, Germany, and Italy. No report on the results of the meeting was available when RUBBER WORLD went to press.

Quality and Packing

"The Group noted," the communique further read, "the progress made at the Second International Rubber Quality and Packing Conference held in New York from May 3rd to 6th, 1955, and expressed the hope that the recommendations of this conference would be generally agreed upon and put speedily into effect, in particular those relating to the establishment of internationally agreed type samples."

This statement was apparently an appeal to compose consumer-dealer differences over a universally accepted set of type samples for grading natural rubber. At the New York conference in May, consumers and dealers were in agreement on 24 of the RMA type samples. They differed on six others. Consumers were pressing for acceptance of all 30 RMA types, and no others; while dealers generally sought to add to the RMA list the newer "Singapore types."

Core of the dispute is the contention of consumers that the Singapore types are about a half-grade below the older RMA types that the dealers, in effect, seek to displace. Dealer groups contest this and argue that the six RMA types of pre-war vintage are no longer produced in adequate quantity. They claim that the Singapore types are more typical of currently produced grades which the older RMA type samples purport to represent. With current price differentials for the various grades as wide as they are, the differences take on a significant dollars-and-cents importance.

Both factions, however, have since made headway toward reconciling their differences. In the past few months three of the original seven Singapore types have been accepted as RMA equivalents by consumers. The likelihood is that, with both sides yielding a bit, remaining differences will be resolved to give once again the world-wide rubber trading community a full set of "internationally agreed type samples" for every grade in current use.

Technically Classified Rubber

The Study Group reviewed the present position of these increasingly popular tailor-made formulations of natural rubber and recommended "that the level of expected demand should be more precisely assessed."

The Study Group accepted the invitation of the Indonesian Government to hold its next annual meeting in Bandoeng in May, 1957. To carry on the affairs of the Group during the intervening 18 months it named a 10-member Management Committee comprising delegates from British Colonial and Dependent Territories, Ceylon, France, the Federal Republic of Germany, Indonesia, Japan, Liberia, The Netherlands, the United Kingdom, and the United States.

Industry Questioned on Government Laboratory Disposal and Basic Research Policy

The special commission evaluating the future of basic research on synthetic rubber and disposal of the Government Laboratories at Akron met in Washington with National Science Foundation officials, October 24. The day-long meeting—from 9:00 to 5:00—covered the whole range of questions presented to the 11-member group by NSF at its initial meeting four weeks before.

It was at that organizational meeting that the commission was asked to advance the date of its final report to NSF's directorate from early January to mid-November. Agreement was reached on getting the report, which will form the basis for recommendations to the Congress in January, to the NSF board on December 1.

Curchack-Kalayjian

William H. Davis, chairman, NSF Rubber Research Commission

Industry Questionnaire Circulated

The commission, operating under the temporary chairman, William H. Davis, a New York patent lawyer and former wartime government administrator, also set in motion at the September 29 meeting two study projects aimed at clearing its path for later decisions. It approved a questionnaire to 140 rubber, oil, and chemical companies to determine the extent of industry interest in either acquiring the Akron Laboratories or contracting out research projects to the Labs on an annual basis. The commission also made an effort to solicit opinions from private and university research groups and other government agencies on the need and scope of future federal financing of basic research in synthetic rubber and related elastomers.

Early results of the questionnaire poll indicated widespread interest in acquiring the Labs or regularly utilizing its services on a commercial contractual basis. The Commission, at the October 24 meeting, also heard reports from Akron University President N. P. Auburn and Lab Manager W. K. Taft on "Operation Project"—their success in lining up private research contracts from several rubber companies. The project was authorized by NSF this summer to gage the ability of the Labs to attract business on regular commercial terms.

Mr. Davis was elected permanent chair-

man; Edwin R. Gilliland, vice chairman; and William E. Coleman, of the NSF staff, executive secretary of the commission at the October 24 meeting.

The Commission also heard a report from one of its six scientist members, Edwin R. Gilliland, chairman of MIT's chemical engineering department, of the views of research scientists on the need of continued government support for basic synthetic rubber research. At the September 29 meeting, Dr. Gilliland was instructed to set up a meeting in Boston for early October of the seven-member ad hoc advisory panel for rubber research, of which he is chairman, to talk over this question. The meeting was washed out by the New England flood.

Dr. Gilliland's report, therefore, covered the views of the several panel members in the Boston area. He also presented the Commission with a synthesis of the opinions of University contractors now engaged in basic rubber research for NSF —opinions solicited by letter, as well as his own recommendations. All these are expected to be made available to the public when the Commission's report goes up to Congress in a few months. The various opinions expressed to the Commission should shed light on what the experts grappling on the frontiers of rubber research consider the most pressing and promising areas for current and future inquiry.

Ad Hoc Research Panel Long Established

The ad hoc advisory panel has been long established, advising the various agencies operating the government synthetic rubber industry on worthwhile research projects. Last spring, when the synthetic plants went over to private ownership, the panel helped NSF winnow out from outstanding University research contracts those aspects of particular projects dealing with applied research intimately tied to the operation of the synthetic producing facilities. It was at the panel's recommendation that NSF decided to set next June 30 as the termination date for the University contracts (the work being conducted under this program was described in our October, 1955, issue).

Other panel members are John T. Blake, research director, Simplex Wire & Cable Co.; Peter J. W. Debye, chemistry department, Cornell University; Paul M. Doty, chemistry department, Harvard University; H. F. Mark, Polymer Research Institute, Brooklyn Polytechnic Institute; C. S. Marvel, chemistry department, University of Illinois; and G. S. Whitby, chemistry department, University of Akron.

The Commission also heard reports on the question of continuing government support for basic rubber research from the Department of Defense and the National Bureau of Standards. In addition to reviewing results of its poll of industry sentiment for disposing of the Laboratories, the Commission considered the position on this question of other federal agencies and of the two Akron representatives—President Auburn and Mr. Taft.

Paul S. Greer, former research chief of the Office of Synthetic Rubber, now attached to the NSF's staff, reported on his

Edwin R. Gilliland, vice chairman, NSF Rubber Research Commission

discussions with University contractors. They had been asked for opinions on the extent to which their work would be affected if the Labs were no longer available—or available only on a commercial fee basis—to evaluate their test-tube experiments.

Among Akron Labs' unique facilities is a pilot plant which can produce small quantities to order of any new synthetic rubber formulations which the basic research scientists develop. These are then evaluated through use tests by the Laboratory.

Sitting in as an observer at the Commission's meeting was a representative of the Office of Defense Mobilization. That agency has assumed responsibility for gathering and synthesizing the views of the various federal departments and agencies on a variety of rubber policy matters —including research needs. The task is being carried out to comply with Section 10 of the Rubber Producing Facilities Disposal Act of 1953 (Public Law 205— 83rd Congress), which reads:

"At the expiration of one year after the transfer period [the government synthetic plants were transferred to private industry in May, 1955] or as soon thereafter as the Congress is in session, the President shall report to the Congress concerning the Nation's rubber requirements and resources, and the need, if any, for further research by the government relative to the production or use of synthetic rubber and its component materials."

Congress to Get Two Research Policy Reports

Thus Congress, in the space of a few months, will receive two government reports embracing the question of continued federal sponsorship and financing of synthetic rubber research. The distinctions, however, are worth noting. NSF was delegated the job by the present Congress of evaluating the need of continued basic research support and was asked also to recommend whether wise policy dictated efforts to dispose of the Akron Laboratories, or their retention, and on what terms.

The President's report, following four months later, goes into a wider range of questions, covering the entire gamut of synthetic rubber research requirements. Section 10 also seems to be a broad enough mandate, should the Administration desire, to take up such basic policy matters as the future composition of the government's defense stockpile of natural rubber, (now under review by the ODM), national policy toward stimulating both synthetic and natural rubber expansion, and anything else encompassed by a consideration of the "Nation's rubber requirements and resources."

The President's report, incidentally, will come along at about the same time that the Attorney General is required to submit a report to Congress on pricing and other competitive conditions in the synthetic rubber producing industry. But, for those who have high hopes that Congress is likely to come to serious grips next summer with this large array of pending rubber policy questions, it is worth a reminder that all the legislators will be giving their most serious—and perhaps exclusive—thought and effort to the quadrennial electoral campaign that will soon be reaching November's climactic showdown.

Institute Plant Negotiations on; Mid '56 Production Likely

The Rubber Disposal Commission settled down to what stacks up as its last piece of business when it launched negotiations to sell the giant Institute, W. Va., GR-S synthetic rubber plant.

Six Bids Received

Negotiations were kicked off after five corporations and California oilman Edwin W. Pauley, answered the Commission's call for bids on the 122,000-ton facility, in "mothballs" since September, 1953. Entering bids for the plant were: Goodrich-Gulf Chemicals, Inc., Goodyear Synthetic Rubber Corp., Imperial Commodities Corp., Union Carbide & Carbon Corp., United Rubber & Chemical Co., and Mr. Pauley.

Goodrich-Gulf, Goodyear, and United Rubber & Chemical already own GR-S plants acquired through disposals earlier this year. Goodrich-Gulf also has a half-interest in a large butadiene plant; while Goodrich itself is the current standby maintenance manager of Institute for the government. Mr. Pauley and his associates were unsuccessful bidders for three Los Angeles synthetic plants. Bidding alone, he was among eight who lost out to United Rubber & Chemical in the recent sale of the Baytown GR-S plant. Carbide wanted to buy the plant last summer for non-rubber use, but never got the chance as Congress passed a bill authorizing sale only for production of synthetic rubber. Disposal will carry the customary 10-year national security clauses requiring active production or maintenance for rubber production throughout that period.

Imperial Commodities, a Dutch-controlled trading firm and importer of natu-

ral rubber, and Union Carbide are both newcomers to the disposal program. Each played a vital role in sparking last July's special legislation authorizing a second try at selling Institute, the erstwhile "white elephant" passed up without a single bid in last year's big disposal round. Carbide made the first move, getting a bill introduced to sell the plant for cannibalizing (then, so now, Institute looked good enough to eat). Just as defense officials were turning thumbs down on this proposal, Imperial came into the picture as a prospective buyer with plans to restore the plant to rubber production. West Virginia's congressional delegation hurriedly dumped the Carbide bill and substituted one to accommodate Imperial.

From the time the legislation was signed by the President in early August until bid deadline October 7, interest in reactivating Institute began to spread through the rubber industry. Despite some inherent drawbacks, the plant— with its 122,000-ton capacity—took on an attraction imparted by the need of rapidly augmenting world supplies of rubber in the face of rising demand. If all goes well, Institute will be back in production about mid-1956.

Even Early '56 Production Possible

Recent plant visitors have come back with the word that at least one of Institute's three production lines (it has three separate and independent units, each equipped to produce about 40,000 tons yearly) can be put on stream in 60 days. Imperial's original plan—now three months old—was to reactivate one line and market most of its product overseas, at least as a starter.

The Commission has until December 21 to negotiate a sales contract. The contract must meet with the approval of the Attorney General and lay before Congress for 30 days. If neither chamber vetoes the proposal during that period, the contract will then take effect.

On its last visit to Institute in September, the Disposal Commission found the plant well-maintained. Its future operator, however, faces the problem of trying to compete with cold rubber plants, endowed with adjacent supplies of petroleum butadiene, or taking the alternative of investing in equipment to convert Institute to cold rubber. Institute is a hot rubber plant, whose nearest source of butadiene is the Louisville alcohol butadiene plant. Its power supply comes from adjacent private facilities owned by Union Carbide. The rubber plant, despite its good safety record, reputedly is so situated that it presents greater than normal explosion hazards.

Supreme Court Will Review du Pont Case

The Supreme Court last month agreed to take up the government's anti-trust suit aimed at forcing E. I. du Pont de Nemours & Co., Inc., and the du Pont family to dispose of their stock in General Motors Corp. and United States Rubber Co.

The court acted on a Justice Department appeal to review dismissal of the civil anti-trust action against du Pont and GM by Federal District Judge Walter J. LaBuy. After a seven-month trial, Judge LaBuy ruled that the government had "failed to prove conspiracy, monopolization, a restraint of trade, or any reasonable probability of a restraint."

The government sought to show monopolization and restraint through an allleged limitation on GM's ability to deal as it pleased with competitors of du Pont and U. S. Rubber in purchasing components and other materials for GM products. Judge LaBuy held, however, there was no limitation.

In agreeing to hear the Justice Department's appeal, the Supreme Court rejected a counter-brief by GM and du Pont that it immediately affirm Judge LaBuy's decision without further argument. The high tribunal is not expected to hand down a final decision for some time, but it may schedule oral argument during its current term.

The suit, when filed in the Chicago District Court in 1939, was described as the biggest anti-trust suit in history. When Judge LaBuy issued his decision last December, the government appealed directly to the Supreme Court. The government brief seeking review said the lower court ruling was "patently erroneous because it ignored the realities of intercorporate relations."

Du Pont and GM in their reply brief said the government's real complaint with Judge LaBuy's decision "is not that evidence which it tendered on the control issue was ignored (by Judge LaBuy), but that the District Court did not make the findings for which the government contended." During the trial the government attempted to show that heavy stock ownership by du Pont interests in GM and U. S. Rubber provided the limitation on GM's ability to act as a free agent in buying those types of materials that du Pont and U. S. Rubber produce.

Government Synthetic Rubber Research Papers Available

The complete collection of technical papers from the Government Synthetic Rubber Program has been made available to the public for the first time, it was announced on October 21 by the Office of Technical Services, United States Department of Commerce.

This rubber research program was started under the War Production Board in World War II and continued under other agencies after the war and recently became the responsibility of NSF which has made the reports available to the public.[1]

The 3,750 reports, covering the period from February 1, 1943, through June 30, 1954, are available only in microfilm or photocopy and may be obtained from the Photoduplication Service, Publication Board Project, of the Library of Congress, Washington 25, D. C. The papers are identified as PB 118310. Microfilmed cards giving title and a brief summary of each of the reports are also available. Prices will be quoted by the Library on request.

Also available is a four-volume compilation of abstracts from the program. It is PB 111736, Abstracts of Technical Papers from the Government Synthetic Rubber Program, which may be ordered from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., price $5 a set.

These abstracts of papers published between 1942 and 1953, in contrast to the availability of all papers both published and unpublished covered by this October 21 announcement, were prepared by the Research & Development Division, Office of Synthetic Rubber, Reconstruction Finance Corp. They include a summary of the research done by the many industrial, institutional, and governmental groups participating in the program and published in various scientific and technical journals.

[1]India RUBBER WORLD, Feb., 1952, p. 585, "The Need of a Full Report of the Government's Synthetic Rubber Program," an editorial.

NAITD Becomes NTD & RA

A new organization—the Tire Retreading Institute—was born last month. Established by the National Association of Independent Tire Dealers, Inc., its purpose is to give the industry a "prestige organization of Master-Tire Retreaders." Membership is open to any tire retreader meeting certain "physical inspection and ethical qualifications needed for certification as a Master-Retread shop," NAITD explained. The Institute will grant a seal of recognition, a special rubber medallion which members can mold on each retreaded tire. Establishment of TRI—as a wing of NAITD—is intended as a major step to promote ethical business practices in the retreading industry. It will be used as a vehicle for promotional campaigns to win over the public to the idea that retread tires—at least those purchased from TRI members—are as safe as any other.

NAITD, partly for this reason and partly for others, changed its own name last month. It is now the NTD & RA—the National Tire Dealers & Retreaders Association, Inc. One reason for the change is the growing retreading business being done by dealers. Another is the need of a stronger identification in the public mind (particularly as regards those Congressmen who were ready last summer to slap a heavy excise on tire retread materials to finance the highway expansion program) of the tire dealer with retread tires. The NTD & RA has made a major, and largely successful, effort to get camelback manufacturers to stop using that obscure word, camelback, and adopt "retread rubber" as a substitute.

It is convinced that one reason Congress was ready to seek a large part of the taxes for the big highway bill from camelback producers and users was that few legislators knew what camelback was and therefore couldn't assess its true vote-pulling power. Now that they know, the word will soon depart from the realm of popular currency if the current "change-the-name" campaign succeeds. If camelback taxes are raised, who's going to pay them?

National News

New Rubber Need Again Emphasized; Additional Synthetic Capacity Planned

Two rubber industry leaders again emphasized the need for increased amounts of new rubber, and more plans to increase synthetic rubber producing capacity in the United States were announced recently.

Firestone on Rubber Needs

Harvey S. Firestone, Jr., chairman, Firestone Tire & Rubber Co., before he left for the International Rubber Study Group meeting in Liberia in mid-October, pointed out that the future holds a great challenge for the producers of both natural and synthetic rubber. This challenge lies in the constantly increasing, worldwide demand for rubber products.

"Production of both synthetic and natural rubber must be increased if the demands of the future are to be adequately met," he said.

It was announced that Firestone had approved plans to expand production capacity at its Akron, O., synthetic rubber plant by 35%, in addition to the 50% increase in production in its Lake Charles, La., plant announced in August. This program brings Firestone's total GR-S type production capacity to more than 190,000 tons a year.

Firestone said that worldwide rubber consumption is now 2,900,000 tons a year and estimated that by 1965 it would rise to 4,300,000 tons a year. The company has been expanding the production capacity of its Liberian natural rubber plantations and now has 90,000 acres in use.

For two years Firestone has been producing a new type of synthetic rubber which duplicates natural rubber in a pilot plant, and more than 500,000 miles of tire tests prove that this new rubber has physical properties at normal and high temperatures equivalent to those of natural.

This new synthetic rubber, which can be used in high-speed truck tires, holds great promise for the future as a rubber that may be superior to natural rubber in many ways and for any uses, it was added. There will always be requirements for natural rubber provided it is priced competitively with synthetic rubber, however.

Firestone has also signed a contract with the Catalytic Construction Co. for the design and construction of a 40,000-ton butadiene plant, which will supply part of the company's requirements for this important raw material for synthetic rubber.

Richardson Sees 50% More Synthetic Needed by 1965

The world will need to expand its facilities for producing synthetic rubbers by 500,000 tons within the next five years, principally in the United States, W. S. Richardson, president, The B. F. Goodrich Co., declared in an address before the Boston Conference on Distribution in Boston, Mass., in mid-October.

The failure of natural rubber supplies to meet total world demand is being made up and must continue to be made up by increased production of synthetic rubber, he added. World consumption of new rubber was estimated at 2,800,000 tons this year and over 3,000,000 tons by 1960.

He pointed out further that without America's "know-how" and facilities for making synthetic rubber the world would be short about 1,000,000 tons this year, and the price for natural rubber would be stated in dollars rather than cents per pound. World prices for natural rubber are at levels that bear no relation to cost of production, and this situation encourages the building of more and more synthetic rubber capacity throughout the world. Research is encouraged to develop synthetic rubber that will replace natural rubber for all purposes.

Meanwhile Goodrich-Gulf Chemicals, Inc., a wholly owned subsidiary of B. F. Goodrich and Gulf Oil Corp., announced in mid-October that it would construct a plant at Avon Lake, O., for the production of a new type synthetic rubber that duplicates natural rubber in almost every respect. Large truck tires made of the new synthetic rubber are now giving road service and mileage comparable to those of tires made of natural rubber, it was further added.

Phillips Expands Synthetic Capacity

Phillips Petroleum Co.'s wholly owned subsidiary, Phillips Chemical Co., will expand by an additional 22% the capacity of its GR-S type rubber plant at Borger, Tex., according to K. S. Adams, chairman, and Paul Endacott, president of both companies, it was announced last month. This expansion is in addition to the 15% capacity increase announced previously.

The production capacity of the adjacent butadiene plant also will be increased to provide additional butadiene required by the copolymer plant. Construction of the new facilities is expected to be completed in the first quarter of 1957.

Other Expansions

Other expansions mentioned elsewhere in this issue include a 50% increase in butadiene production capacity by Petro-Tex Chemical Corp., jointly and equally owned subsidiary of Tennessee Gas Transmission Corp. and Food Machinery & Chemical Corp., at Houston, Tex., to 135,000 tons, and construction of a full-scale plant for the manufacture of "Hypalon" chlorosulfonated polyethylene rubber at Beaumont, Tex., by the du Pont company.

Floods Again Plague New England

Damage to New England plants of U. S. Rubber during the floods of the week-end of October 15-16 were only a fraction of the damage caused by the flash flood of August 19, H. E. Humphreys, Jr., president, said on October 17, and the October flood damage is not expected to exceed one million dollars.

Although production in the footwear and chemical plants located in Naugatuck, Conn., was stopped, shipment of finished products was not. There was no loss of either raw material or finished goods inventories. Production was resumed in 24 to 48 hours at both plants, with minor exceptions.

Reclaimed rubber production was resumed within two or three days, as was production in the synthetic rubber plant.

Damage was very slight to the footwear plant in Woonsocket, R. I., and the tire plant in Chicopee Falls, Mass. Production was not interrupted at these plants.

The nature of the October flood was different from that of the August flash flood, and different areas of New England suffered more; while some of the areas hard hit by the August floods were spared. As a result, damage in the rubber industry in this area was less in October.

Commerce Department's "Review and Prospects for 1955"

In addition to the Commerce Department's reports on rubber industry business indicators present on pages 95 and 96 of our October issue, some additional information appears in the "Industry Report—Chemical and Rubber," for September by that government department, under the heading of "1955 Review and Prospects."

Although the rubber products industry faces some decline in the last five months of 1955 due to lower automobile output, new records for the year as a whole will be established in product output, rubber consumption, and sales volume, it was said.

Tire production for passenger cars, trucks, and buses is expected to pass the 100-million mark for the first time, with 1955 output of passenger-car tires expected to be about 89 million and that for truck and bus tires, 14 million.

There is no evidence of a satisfactory "normal" seasonal trend for United States new rubber consumption. In the years since 1946, the first half of the calendar year has

accounted for as much as 55% (in 1953) of the annual total, and as little as 48% (in 1950). Various industry estimates for 1955 consumption of new rubber have ranged lately from 1,400,000 to nearly 1,500,000 tons. An average figure of 1,440,000 tons was considered not unreasonable, but if this figure is realized, consumption in the last five months of 1955 will exceed the previous high record for the same period, in 1950, by 2.4%.

With rubber products manufacturers' sales totaling $2,249 million in the first five months of 1955, and the price index of tires and tubes at its highest postwar level, following three increases so far this year, the 1953 record sales volume of $5,097 million will be exceeded.

The number of production workers in the rubber products industry averaged 213,000 in the first seven months of 1955, as against 221,000 in the calendar year 1953, and 195,000 in 1954. In the first half of 1953, the heavy production period of that year, the average number of production workers was 226,000. The smaller number thus far in 1955, with tonnage throughout much heavier, indicates a distinct increase in productivity per worker, although workers averaged longer hours so far this year than in 1953, the Commerce Department said.

URWA Entertains Industry Leaders; Wage Pacts Signed

Officers of the United Rubber Workers, CIO, union entertained industry leaders at the offices of the international union in Akron, O., in early October. The occasion was a twentieth anniversary celebration of the union and was held at the newly remodeled headquarters building in Akron. L. S. Buckmaster, international union president; Joseph Childs, vice president; Desmond Walker, secretary-treasurer; Herbert Dawson, assistant to the president; and other union officials greeted the visitors.

P. W. Litchfield headed a group from Goodyear Tire & Rubber Co.; and a group from Firestone Tire & Rubber Co. included Lee Jackson, president, J. E. Trainer, executive vice president, and Joseph Thomas, secretary and counsel. John L. Collyer, chairman, and W. S. Richardson, president, B. F. Goodrich Co., were present with other members of that firm, and the group from Seiberling Rubber Co. included J. P. Seiberling, president, Harry Schrank, vice president, and Douglas Mueller, assistant to the president.

E. M. Cushing, director of industrial relations, U. S. Rubber, and many others from the industry were among those touring the URWA headquarters offices.

Exhibits at the URWA building described the growth of the union from 3,000 members 20 years ago to 200,000 now and revealed that it has assets, including a $850,000 strike defense fund, of more than $2,000,000.

Meanwhile General Tire & Rubber Co., U. S. Rubber, and Seiberling all signed new wage contracts with URWA in late September in which production employes were granted a wage increase of 12¢ an hour.

These contracts follow the pattern set by the contracts signed by Firestone, Goodyear, and Goodrich with the union in August and early September.

Provisions of the agreements include an 8¢-an-hour additional increase for employes in certain craft and maintenance classifications. In the Seiberling contract another 4¢-an-hour increase was granted for certain jobs in the Barberton plant.

Other Industry News

Goodyear Has $100-Million Plant Improvement Program

The Goodyear Tire & Rubber Co. has embarked upon a two-year plant expansion and improvement program involving the capital outlay of $100 million, according to Board Chairman P. W. Litchfield, who explained this program covered several new plants here and abroad as well as expansion and modernization of other plants and of the company's wholesale and retail distribution facilities.

Part of the program has already been completed; some is under way, and the remainder is in the approved stage. Some projects, moreover, are now in the planning stage, but are not yet ready to be announced.

In the United States new plants or additions to present ones are scheduled for Akron, O., Houston, Tex., Jackson, Mich., Niagara Falls, N. Y., and Litchfield Park, Ariz.

New plants abroad include tire factories in Scotland, Colombia, and Venezuela.

At Akron, Goodyear will invest $3½ million in a capacity increase to the Chemigum and resin plant for the production of nitrile rubber and latices. Also, $3.3 million is being invested in a new research and development laboratory and other improvements for the subsidiary, Goodyear Aircraft Corp., and a $2½ million addition to the capacity of the Airfoam plant making foamed rubber products.

A $4½-million addition to the tire plant at Jackson, which produces original-equipment tires for the automotive industry, is nearing completion.

Six million dollars will go into expansion of the synthetic rubber plants at Akron and Houston, recently taken over from the government.

Other expansions include $500,000 at the chemical plant at Niagara Falls and $240,000 for a new aircraft and electronics laboratory at Litchfield Park.

Also scheduled is a multi-million-dollar expenditure for equipment changes at all Goodyear tire plants. A major portion of this allotment will go into additional 3-T machines used in the treatment of fabric for the company's tubeless tires.

Under the direction of Goodyear-Great Britain the tire and tube plant at Wolverhampton is being enlarged substantially, and a new tire plant in Glasgow will take care of the rapidly growing volume of business.

Goodyear tire and tube plants in Luxembourg and Sweden also are being substantially enlarged.

Expansion and modernization of the company's product distribution facilities include a $5-million distribution center in the Cleveland area containing 680,000 square feet of storage space to service retail outlets in a several-state area.

Dimethyl Silicone Oils Now in Lower Viscosities

Linde Air Products, a division of Union Carbide & Carbon Corp., New York, N. Y., now makes dimethyl silicone oils in 50 centistokes viscosity as well as in 100 centistokes and higher viscosities. The methyl silicone oils are clear, water-white fluids that can be made in viscosities from water-thin liquids to thick materials. As straight oils they are marketed by Linde as its L-45 line; in emulsion form, as LE-45.

The electrical industry has been an important consumer of the oil in 100 centistokes viscosity as an insulating fluid in aircraft transformers. In the new lower viscosity the oil is expected to be used also to fill capacitors and sealed electronic assemblies.

In the middle viscosities of 200-500 centistokes the oil has many applications, including use as parting agent in the rubber industry.

Goodrich Synthetic Fiber

A dinitrile synthetic fiber has been developed by B. F. Goodrich Chemical Co., Cleveland, O., and is currently in pilot-plant production at Avon Lake, O. Called Darlan, the fiber, made of 1, 1 dicyanoethylene, is said to be versatile and adaptable for almost every type of wearing apparel.

First commercial application is reported to be in women's pile coats to be introduced across the nation later this year.

Goodrich holds more than 45 patents covering the fiber.

Harry A. Cole

William T. Bisson

Bisson Joins RUBBER WORLD As Sales Manager

William T. Bisson, of Medina, O., has joined the staff of RUBBER WORLD with the title of sales manager. He is also on the staff of *Plastics Technology*, as sales manager. He will have offices in Akron and Cleveland, O., and this set-up will provide for closer contact in the important Midwest area with advertisers in both publications.

Mr. Bisson attended Western Reserve University and then served as secretary of the Alumni Association before becoming an account executive with Central Outdoor Advertising. Most recently, he was Cleveland district manager for Reinhold Publishing Corp., handling advertising for it for the American Chemical Society's publication, *Chemical and Engineering News*.

Bill Bisson, as he is known to his many friends in the publishing field, spent four years in the U. S. Army, mostly in the African and European theatres and held the rank of captain of the infantry when discharged.

He makes his home in Medina, is married, and has two daughters and a son.

GE Develops High Voltage Butyl Rubber—Hy-Bute/60

The discovery of a way to fortify organic compounds against high-voltage electrical discharges has resulted in the development of a form of reinforced butyl from which high-voltage outdoor instrument transformers will be molded, accordinging to E. E. Parker, general manager of the instrument department of General Electric Co., Lynn, Mass., which developed the technique after several years of research.

Called Hy-Bute/60, the transformed butyl rubber incorporates a chemical mechanism which prevents the formation of free carbon thus precluding the formation of a carbon track and the consequent failure that occurs when organic components of the insulation break down, Mr. Parker reported.

Tests, both in the laboratory and in cooperation with several public utilities, are said to have demonstrated the ability of Hy-Bute/60 to withstand severe atmospheric conditions, including fog and spray in seacoast locations. The first application of the processed rubber will be in a 15kv instrument current transformer to be made available in January.

Hy-Bute/60 and the basic chemical mechanism that made it possible were the subjects of two papers delivered before the American Institute of Electrical Engineers in Chicago, October 3-7, by General Electric researchers R. S. Norman, R. A. Pfuntner, and A. A. Kessel. The papers are entitled "Non-Tracking Organic Insulations" and "The Application of a New Non-Tracking Butyl to High-Voltage Instrument Transformers," and copies, CP 55-699 and 55-715, are available from the Institute at 33 W. 39th St., New York 18, N.Y. Price is 40¢ per copy for members, 80¢ to non-members.

Du Pont's First Full-Scale Hypalon Plant

Plans for the construction of the first full-scale plant for the manufacture of "Hypalon" chemical rubber at Beaumont, Tex., have been announced by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. Limited quantities of the rubber for purposes of evaluation have so far been supplied by an interim plant at Belle, W. Va.

The new plant is scheduled for completion during the first part of 1957 and will consist of two manufacturing buildings and a warehouse. About 70 men will be employed. The company's existing Beaumont Works started operation a year ago with the manufacture of methionine, an essential amino acid used as a poultry feed supplement.

New Chemigum Quality Lab

A modern quality-control laboratory has been installed in the Chemigum plant of The Goodyear Tire & Rubber Co.'s chemical division, Akron, O. The laboratory is staffed by a permanent quality control team responsible for checking the purity requirements of raw and in-process materials, as well as of the finished products, including Chemigum rubbers and latices, Pliolite rubber resins and latices, and Pliolite reinforcing resins.

Such renovations as an air filtration system, a rebuilt dryer, and a new electronic metal detector have been installed in the plant, the company says. Control tests are run at predetermined intervals on representative samples. Also installed is a 12-station sending and receiving page system which permits communication with plant manager or department heads at various control points.

Sub-Tread Wire Mesh Tire Introduced by U. S. Rubber

Passenger-car and truck tires reinforced with a sub-tread mesh of steel wire have been introduced by United States Rubber Co., New York, N. Y. The wire, said to make a tire tread virtually puncture-proof, is used in addition to flexible textiles in the carcass and sidewall.

The reinforcing high-strength steel wire, stranded from thin filaments, lies in two criss-crossed layers beneath the tread, giving the effect of a fine-mesh steel cloth. A hoop of two layers of the wire is embedded in rubber at the base of the tread, forming a shield that protects the carcass and makes a permanent bond between tread and carcass, the company declares.

Each tire is said to contain from one to eight miles of steel wire as strong as that in bridge cable.

Other advantages of the wire mesh are said to be a 20-40 degree cooler-running tire, increased cut resistance, elimination of tread cut growth, reduction of the danger of centrifugal force throwing off treads at high speeds, and increased tread mileage.

According to U. S. Rubber, the tire design marks the first time a major rubber manufacturer has used wire successfully in a passenger-car tire although tire engineers have been experimenting with it for more than 20 years. Wire truck tires are on the market, but they use all-wire construction, eliminating the use of textiles, the company adds.

Wire is being offered in U. S. Rubber's line of six new Royal Master Premium tubeless tires in all passenger-car sizes, and in a choice of sidewall construction and color, and in the company's Fleetway and Super-Fleetway truck tires in sizes ranging from 600x16 to 1100x20.

New U. S. Rubber tire showing sub-tread mesh of steel wire

Herman Muehlstein Presents Rare Books to Akron U.

Herman Muehlstein, of New York, noted philanthropist and president of the rubber and plastics firm that bears his name, on October 1 attended a ceremony at the University of Akron, Akron, O., honoring his gift of more than $100,000 in rare books. He brought with him three books for immediate turnover: an Elizabeth Barrett Browning first edition; George Chapman's first-edition translation of Homer's "Iliad"; and Charles Dickens' first edition of "The Adventures of Oliver Twist."

To be turned over upon Mr. Muehlstein's death are 297 other books, including Lewis Carroll's original "Alice in Wonderland."

The gift was accepted by Dr. Norman P. Auburn, University president, who observed that the acquisition would not only enhance the University's academic prestige, but would put the University library past the 100,000-volume mark.

In Mr. Muehlstein's initial gift also were 12 reference volumes of Elsevier's "Encyclopedia of Organic Chemistry" and the 58-book set that comprises the British Museum catalog. All these he had purchased especially for Akron U.

During the brief and informal ceremony at the campus Dr. Auburn revived the once-active "Friends of the University Library" group, and Mr. Muhlstein accepted the title of honorary chairman.

Herman Muehlstein (second right) donating rare books to Akron University. Those watching are Dr. Norman P. Auburn (left), Dr. Paul M. Zeis; and Miss Dorothy Hamlen

Paul M. Zeis, assistant vice president of the Akron, Canton & Youngstown Railroad Co., was named active chairman; while Miss Dorothy Hamlen, University librarian, will assist him as secretary.

General Tire's O'Neil Views Firm's 40-Year Growth

Development of a new synthetic rubber composition for tires has been revealed by William O'Neil, president, The General Tire & Rubber Co., Akron, O., in a fortieth anniversary report tracing the financial rise of the company since its organization in 1915 with a total capital of $200,000.

Called Hi-Density, the new rubber composition is a fusion of special-quality carbon black with a new formula of wear-resistant rubber, combining extra toughness and durability, Mr. O'Neil said in asserting that it was the biggest single step to date toward the building of the 100,000-mile tire for passenger automobiles.

Also reported was that the company's chemical division had recently begun the production and marketing of paint-latex for interior rubber-base paints and rubber chemicals.

Exemplifying the growth of General Tire's plastic division was the announcement that its sales had reached $50,000,050 for the first nine months of 1955, compared to $34,525,000 for the entire year of 1954.

In another field, Mr. O'Neil revealed that a company subsidiary, Aerojet-General, with plants in Azusa and Sacramento, Calif., and said to be the world's largest commercial manufacturer of rocket engines and propellants, had submitted a proposal to build the propulsion plant for this country's proposed earth-circling satellite which will be shot into outer space during the Geophysical Year, 1956-57.

"General Tire's growth during the past 40 years has been sure and steady," the tire executive declared in summary. "There is every indication in the parent company and its subsidiaries that this growth will continue."

U.S. Formally Opens Latex Plant in South

John E. Caskey, vice president and general manager, Naugatuck Chemical, division of United States Rubber Co., was the principal speaker at the firm's formal dedication ceremonies on October 12 marking the opening of its new latex processing plant at Gastonia, N. C.

He mentioned the South's tremendous opportunities for expansion to a chemical company and cited the area's good power and raw materials sources, which are attracting more and more industrial users of the rubber company's chemical products. That is why, he added, the company built the plant in Gastonia and also recently expanded its chemical plant in Baton Rouge, La.

The new Gastonia installation was inspected by members of the area's industrial and civic groups and other Naugatuck Chemical officials, including: Harold M. Parsekian, assistant general sales manager; Albert Holmberg, latex and Lotol sales manager, who will superivse sale of the plant's products; L. H. Howland, manager of colloidal products research and development; and C. R. Peaker, Dr. Howland's assistant. The inspection tour was conducted by Claude H. Allard, new branch manager for Naugatuck in Gastonia.

Actually, the plant went into operation early in September. It supplies formulations of natural and synthetic rubber latex to the South's textile industry and other industrial users of these formulations.

The new plant is also used to warehouse unformulated natural and synthetic rubber latex and supplies of the division's agricultural chemicals. Besides it is the sales headquarters for formulated and unformulated latex in the South.

Win "Joshua" Awards

General Latex & Chemical Corp., Cambridge, Mass., and Acushnet Products Co., New Bedford, Mass., have been voted "Joshua" award certificates for distinguished use of match-book advertising during 1955, according to Charles Furcolowe, director of the Match Industry Information Bureau.

The Acushnet match book, promoting the company's precision molded rubber and silicones, for striking appearance and a detailed sales presentation was judged the most effective promotionally in the rubber industry. A variety of rubber products, embossed and in color, appears on the front cover with the question, "What's your shape?" Inside the cover the question is repeated to lead into a detailed account of Acushnet's specialized service to clients.

The General Latex match book was chosen because its striking red-and-white cover design dramatized the company's dual role as importer and compounder of natural and synthetic rubber latex. Notable art work combined the motifs of rubber plantation labor and modern plant operation.

Flexmount Engine Mounting

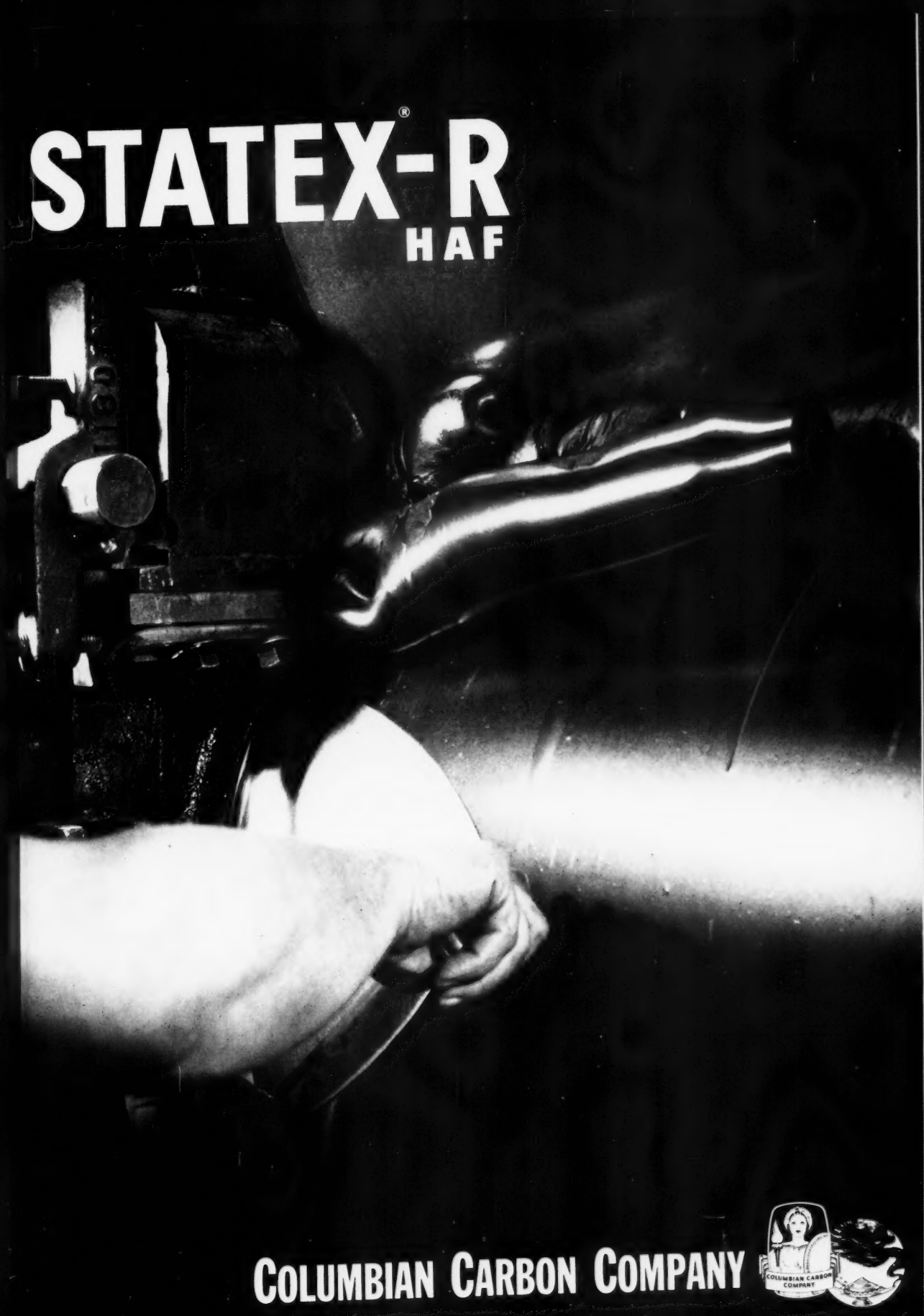
Lightweight aluminum and rubber sandwich support bracket and shock mountings for industrial and aircraft applications have been developed jointly by Stillman Rubber Co., Culver City, Calif., and Lockheed Aircraft Corp., Los Angeles, Calif. Called Stillman Flexmount, the unit is designed to withstand applied loads in shear and additional resultant loads caused by engine vibrations.

According to Stillman, the loads are taken out by 11¼-inch diameter bolts, with the vibrations absorbed by a 1 1/16- by 1⅛- by 1¼-inch neoprene core deep bonded to the aluminum. Previous all-metal designs were said to have been unsuccessful because of vibration. The Flexmount's neoprene core can be replaced when worn, giving the unit theoretic unlimited service life.

Operating temperature of the device ranges from —65° to 175° F.

Four Flexmounts are now in use to support the after-body installations of the Wright 972TC18DA3 engine.

STATEX®-R
HAF



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STATEX®-125 ISAF
(Intermediate Super Abrasion Furnace)

STATEX-R HAF
(High Abrasion Furnace)

STANDARD MICRONEX® MPC
(Medium Processing Channel)

MICRONEX W-6 EPC
(Easy Processing Channel)

STATEX-B FF
(Fine Furnace)

STATEX-M FEF
(Fast Extruding Furnace)

STATEX-93 HMF
(High Modulus Furnace)

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(Semi-Reinforcing Furnace)

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380 Madison Avenue, New York 17, N. Y.

...because they went to their doctors in time

Many thousands of Americans are being cured of cancer every year. More and more people are going to their doctors *in time*. That is encouraging!

But the tragic fact, our doctors tell us, is that every third cancer death is a needless death... *twice* as many could be saved.

A great many cancers can be cured, but only if properly treated before they have begun to spread or "colonize" in other parts of the body.

YOUR BEST CANCER INSURANCE is (1) to see your doctor *every year* for a thorough checkup, no matter how *well* you may feel (2) to see your doctor *immediately* at the first sign of any one of the 7 danger signals that may mean cancer.

For a list of those life-saving warning signals and other facts of *life* about cancer, call the American Cancer Society office nearest you or simply write to "Cancer" in care of your local Post Office.

American Cancer Society

Cabot Ups Carbon Black Output in Canada

Cabot Carbon of Canada, Ltd., Sarnia, Ont., according to P. H. J. Delacour, executive vice president, is expanding its plant facilities to increase production of oil furnace carbon blacks from 20 million to 55 million pounds annually.

"Expansion," stated Mr. Delacour, "should be completed during the next two months, permitting almost three times the original plant production of a variety of oil furnace blacks to meet Canada's increasing industrial requirements.

"This increase," continued Mr. Delacour, "should be sufficient for the present and future anticipated oil furnace black requirements of the entire Canadian rubber manufacturing industry."

The Sarnia plant, which began operations in 1953, has been producing primarily HAF blacks, including the ISAF type. The plant is also producing FEF blacks and will continue to make increasing quantities of this type. Provision has also been made for the manufacture of other blacks as needed by the Canadian rubber industry.

The highly aromatic liquid hydrocarbons used for production of oil furnace blacks are being supplied largely by Canadian refineries.

Gussett Boiler Purchased

Gussett Boiler & Welding, Inc., Canton, O., fabricator of custom-built tanks, autoclaves, pressure vessels, and weldments, has been purchased by J. F. Hattersley, formerly president of The Hoover Co., vacuum cleaner manufacturer.

The new directors of the company will be Mr. Hattersley, chairman of the board and assistant treasurer; R. F. Hattersley, president; G. E. Gussett, Jr., vice president of sales; and Mildred D. Hattersley, secretary.

J. F. Hattersley, associated with The Hoover Co. from 1920 until his retirement in 1954, remains a member of that company's board of directors. R. F. Hattersley was also formerly associated with The Hoover Co., in its production division, and more recently was plant superintendent for Jack N. Heintz Co. Mr. Gussett served in engineering and sales capacity for Gussett Boiler & Welding.

Honor Firestone Chairman

Harvey S. Firestone, Jr., chairman and chief executive of The Firestone Tire & Rubber Co., Akron, O., has been named national chairman of Brotherhood Week, to be observed February 19-26, 1956, according to a joint announcement released by Benjamin F. Fairless, former board chairman of U. S. Steel Corp.; Roger W. Straus, board chairman, American Smelting & Refining Co.; and James F. Twohy, West Coast industrialist, co-chairman of the National Conference of Christians & Jews, sponsor of Brotherhood Week.

Richard Case Honored for Timing Belt Invention

Richard Y. Case, assistant manager and chief engineer, power transmission department, United States Rubber Co., New York, N. Y., was awarded the Edward Longstreth Medal of the Franklin Institute, Philadelphia, Pa., at the Institute's annual Medal Day ceremonies, October 19.

According to the Institute, Mr. Case was cited "in consideration of his invention of the 'timing belt,' a rubber and fabric belt with teeth that makes engagement with axially grooved pulleys, producing a completely positive drive that does not depend upon frictional grip for the transmission of power, and makes possible precision timing between two or more shafts."

Commercially designated the U. S. PowerGrip and Gilmer timing belts, the units are said to be radically different media for the transmission of power, fulfilling the need of a power drive which will not slip. Stretchless and requiring no lubrication, the belts will attain speeds of up to 16,000 feet per minute and operate more quietly than precision gears running in an oil bath.

Mr. Case is an author and lecturer on the subject of power transmission. He contributed a chapter to RUBBER WORLD'S "Machinery and Equipment for Rubber and Plastics," and is the author of the text, "Timing Belt Drive Engineering Handbook."

More Huber Carbon Blacks

J. M. Huber Corp., New York, N. Y., plans construction of a new unit that will increase output of its furnace blacks by 15%. This new unit will be built at Borger, Tex., where the company recently put into production another new unit. When the currently planned furnace plant goes into full production the latter part of 1956, initial output will be of the SRF type of carbon black.

H. W. Huber, company president, reveals that the new unit will have an output of 20 to 30 million pounds of black yearly, depending upon the grade produced and representing an expansion of about 15% in Huber's existing furnace black capacity.

Huber currently has four furnace black units in operation at Borger and two at Eldon, Tex., besides its extensive channel black plant at Borger.

More Ethylene by Monsanto

The plastics division of Monsanto Chemical Co. at Texas City, Tex., plans a multi-million-dollar expansion of ethylene production whereby production capacity will be increased by 150%.

Construction should start in March, 1956, and operation of the facilities a year later.

The plant uses ethylene as an intermediate in the manufacture of polyethylene, styrene monomer, and vinyl chloride monomer. Monsanto's entire ethylene production is earmarked for company use.

Movie on Standard-Quality Vinyl Film

The Society of the Plastics Industry, Inc., has made available to all those concerned with the sale of standard-quality vinyl film an eight-minute motion picture that portrays the story of such film, explaining the meaning of the standards set by the industry and the United States Department of Commerce.

This movie, "The Story of Standard-Quality Vinyl Film," should prove useful for fabricators and retailers in sales training programs.

In addition a five-minute portion of the picture will be distributed to about 100 television stations all over the country as a means of educating the consumer to ask for the Seal of Quality when purchasing products of vinyl film.

Among the points covered in "The Story" are gages and textures of vinyl film; best use of each type for products encountered in the daily life of the consumer; tests which must be passed by the vinyl film in order to win the Seal; hints to consumers in buying vinyl products; means whereby fabricators and retailers can realize on the sales potentialities of the industry campaign; and the importance of vinyl film to modern living.

Timken Expansion Program

The Timken Roller Bearing Co., Canton, O., last month announced a multi-million-dollar expansion and modernization program which calls for a $7-million budget for 1956 to purchase new equipment and increase the capacities of the steel and tube, rock bit, and bearing divisions.

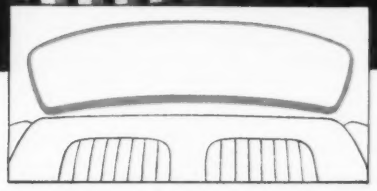
Some of the improvements included are the enlargement and modernization of the company's Gambrinus tube mill, installation of two annealing furnaces, construction of an oxygen plant and also of a central warehouse at the Bucyrus plant, and the purchase of automatic screw machines and grinding equipment for all plants of the company.

An additional $5-million budget was established for the purchase of facilities to produce railroad bearings.

New Goodrich Warehouse

The B. F. Goodrich Co., Akron, O., is constructing a new distribution center on a ten-acre tract of land in the Fairfax industrial area of Kansas City, Kan., that it says will make possible overnight deliveries of the company products throughout Kansas, Nebraska, Missouri, and part of Iowa.

To be ready for occupancy about February, 1956, the center will be a one-story brick-and-steel building with 175,000 square feet of floor space and dimensions of 382 by 432 feet; it will include an office extension. The warehouse will store tires, rubber conveyor and transmission belting, hose, auto and home supplies, freezers, and bicycles. Trackage of the Union Pacific railroad will be used.



Dodge selects Enjay Butyl rubber for big rear-window weatherstrip

Super-durable Enjay Butyl fits perfectly Dodge's rigid specifications for its rear-window weatherstrip. Under the toughest conditions of weather and use, Enjay Butyl parts stay like new, help add style and color to new cars. In fact, some automobiles have more than 100 parts made of this fabulous rubber.

The many advantages of Enjay Butyl make it the almost perfect rubber for the automotive industry. Its price and ready availability are advantages, too. And it is now available in non-staining grades for *white* and *light-colored* parts. For full information and for skilled technical assistance in the uses of Enjay Butyl, contact the Enjay Company at either of the addresses below.

ENJAY BUTYL

Enjay Butyl is the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.

ENJAY **ENJAY COMPANY, INC.,** 15 West 51st Street, New York 19, N. Y.
District Office: 11 South Portage Path, Akron 3, Ohio.

35 SUCCESSFUL YEARS OF LEADERSHIP IN SERVING INDUSTRY

John Royle & Sons Passes Century Mark

John Royle & Sons, Paterson, N. J., manufacturer of equipment for the rubber and plastics industries, is celebrating its one hundredth year of existence, having been founded in 1855 by John Royle, an English immigrant, according to the September 15 issue of *The Royle Forum*, a company publication.

The publication describes the century-long expansion of the firm from its original location in a single rented room where such specialties as pumps were made. The historical development is illustrated by photographs of many of the company's machines; the earliest is an 1860 router. Also included is a photograph of an 1880 Royle tuber which formed rubber into a seamless tube by forcing the compound through a die under screw pressure.

Later developments pictured and described include the Spirod, a machine for extruding polyethylene and nylon wire insulation. This embodied a cast-steel, one-piece cylinder with tubular heating elements carried in spirally formed exterior grooves and enclosed in an insulating jacket.

According to the publication, evolution of the Spirod extruder continued so that this year's model is equipped with a single wrap tubular heating element in each turn of the spiral grooving, providing a maximum number of heating elements and the best situation for elective voltage and balanced phase accommodation with the greatest possible number of temperature zones and the opportunity for half, as well as full, voltage operation.

Phillips Chemical Expanding

A one-story annex is being added to Phillips Chemical Co.'s leased three-story office and sales service laboratory building at 318 Water St., Akron, O., headquarters for the company's rubber chemicals division. This annex, being constructed for eventual expansion to three stories, will be completed late in December. It will be 80 by 40 feet and will be used for storage purposes, releasing space in the main building for additional offices and laboratory equipment.

The present three-story building was completed in August, 1953. The first floor is devoted to rendering direct service to customers on technical problems involving application of the company's carbon blacks (Philblacks) and synthetic rubbers (Philprenes). Lynn Harbison is manager of the laboratory; while J. F. Svetlik is technical service manager and directs the overall sales service program.

The rubber chemicals division sales personnel occupies the second floor, which holds a laboratory for studies of the fundamental structure of carbon blacks and rubber. George E. Popp is manager of domestic sales.

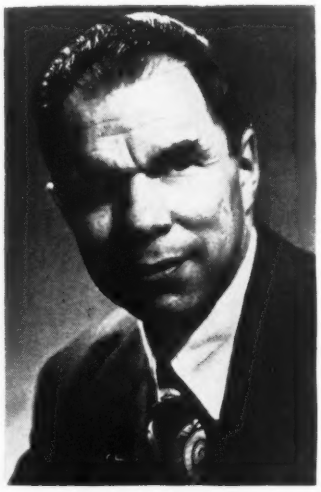
The third floor, formerly used for storage, will be converted to office space for additional personnel.

Phillips Chemical Co. is a wholly owned subsidiary of Phillips Petroleum Co.

Call Goodyear Stockholders

Stockholders of The Goodyear Tire & Rubber Co., Akron, O., will meet November 22 to act on the following two proposals: adoption of a new Code of Regulations, modernized to conform to the newly effective Ohio Corporation Act; and approval of a revised employe pension program recently negotiated with the union representing various groups of employes.

The announcement was made at a meeting of the company's board of directors, October 11. The board also revealed that Kenneth A. Spencer had been named a director, filling the vacancy created by the death of George A. Sloan.



Glenn T. Seaborg

Engages Atom Scientists

Glenn T. Seaborg, Nobel prize winner and codiscoverer of Plutonium, and James W. Cobble, formerly of Oak Ridge National Laboratory and the Radiation Laboratory of the University of California, have been engaged as consultants on atomic energy by United States Rubber Co., N. Y. Dr. Seaborg is currently professor of chemistry at the University of California; Dr. Cobble is assistant professor of chemistry at Purdue University and director of its heavy element project.

At the same time, U. S. Rubber also announced plans to install a two-million volt Van de Graaff electron accelerator at its research center in Preakness, N. J., now under construction. The company recently joined seven other industrial firms in a project to build and operate private industry's first nuclear research reactor.

Commenting on these developments, Sidney M. Cadwell, the firm's director of research and development, said, "It is an opportunity for our company to apply, expand, and develop the advances made by atomic energy to rubber, plastics, textiles, and chemicals—all fields in which we have a vital stake."

Use of Nylon in Tires Up

A survey by E. I. du Pont de Nemours & Co., Inc., reported at the annual convention of the National Association of Independent Tire Dealers, indicated that twice as many persons are now riding on nylon cord tires as were a year ago. The report further revealed that the retail dollar volume of nylon tires has more than doubled in the last year and has quadrupled in two years.

Every tire manufacturer now has nylon cord among both passenger and truck tires. A year ago 39 brands of nylon cord tires were on the market; today there are 241. Passenger tire brands rose from three in 1953 to 27 in 1954 and 86 in 1955. Respective figures for truck tire brands are four, 12, and 155.

Nylon reinforced tires made possible operation of heavy bombers during World War II, it was further reported, just as today such tires are so satisfactory for high-speed jets and heavy planes. Now all of the nation's major commercial airlines are 100% on nylon cord tires.

Where service is severe, moreover, nylon tires are said to be more and more in demand because they offer safety and economy. For instance, highway police who frequently travel long distances at high speed are requesting nylon. Race drivers also are insisting on nylon tires.

Crown Foam-Coating Unit

What is said to be the world's largest single production unit for coating materials in continuous lengths with foam rubber has been put into operation by Crown Rubber Co., Fremont, O. The unit, housed in a specially built building, is said to feature a continuous stainless steel belt of record width and is producing foam coatings on multiple webs and varying widths of materials simultaneously.

The company cites a single-shift production figure of 1,000 one-piece nine- by 12-foot carpet underlays as an example of the new unit's capabilities. The foam rubber is being bonded to such materials as felts, plastic films, paper, fabrics, and knitted goods.

Lea Fabrics' Foam Goods

Lea Fabrics, Inc., Newark, N. J., manufacturer of floor coverings for the automotive industry, has introduced a new fabric-baked foam rubber line of products, it has been revealed by Ellery K. Files, president. Included are brassiere padding, paper and terry cloth fatigue mats, fabrics for shoe uppers and insoles, upholstery fabrics, and cushions and seat pads for stadium use. The company designed and built the machinery to cast foam rubber and developed new methods of formulating foam, he added.

The company is also conducting developmental work with polyurethane foam, Mr. Files said. An intensive sales promotion and merchandising program to introduce the new products to the general market is expected to be launched shortly.

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Hercules to Make "Hyfax," Higher Weight Polyethylene

The launching of production of a new type of high molecular weight polyethylene, a field relatively unexplored in this country, has been announced by Hercules Powder Co., Wilmington, Del.

The new polyethylene material is said to offer greater rigidity than conventional polyethylene, better appearance, greater strength and heat resistance, and a reduction in fluid permeability. Applications are expected to include kitchenware, toys, piping, and other household and industrial uses.

Hercules will trade mark the new polyethylene "Hyfax."

The company is converting and expanding its plant at Parlin, N. J., for the purpose of manufacturing the material at an annual rate of 30 million pounds. The conversion will cost approximately $10,000,000. The Parlin facilities have heretofore been used for the production of nitrocellulose, nitric acid, cellulose acetate, chlorinated rubber, chlorinated paraffin, and plastic molding powders.

Although the production of Hyfax is not expected to get under way before late in 1956, small tonnages will be made available to American manufacturers for exploratory use at the beginning of 1956. This material will be supplied to Hercules by Farbwerke Hoechst AG, a German firm, which itself expects to enter commercial production only at the beginning of next year. Hoechst is one of the first chemical companies to be granted a license to produce the polyethylene by its developer, Karl Ziegler, of the Max Planck Institute, Muelheim, Germany.

According to Hercules, Dr. Ziegler's discovery that ethylene could be polymerized to give a new type of polyethylene with many properties improved over the old type resulted from his work on new types of catalysts, which are now expected to open up a whole new field of catalytic chemistry particularly adaptable to the petroleum industry.

Hercules has obtained from the German scientist the exclusive right to sell a basic component of the Ziegler catalyst in the United States and Canada. Its contract with Hoechst also provides for continuing exchange of research information between the two companies.

Two years in negotiation, these contracts enable the American firm to bypass the pilot-plant stage of production and go directly into commercial manufacture, Hercules declares.

The two firms working together would, in addition, give both the advantage of evaluating the new plastic in two separate markets, according to Elmer F. Hinner, general manager of Hercules' cellulose products department, which will be responsible for production and sales of "Hyfax."

Geon Plant for Canada

A $3,500,000 chemical plant will be built by B. F. Goodrich Canada, Ltd., near Niagara Falls, Ont., Canada, for the production of Geon polyvinyl plastic materials, it was announced jointly by J. R. Hoover, president, B. F. Goodrich Chemical Co., and Ira G. Needles, president of the Canadian firm.

Construction of the project will start early in 1956, with completion scheduled for early 1957. The site of the plant is on land between Welland and Niagara Falls, in Thorold Township, purchased by the company more than a year ago. Since the facilities will be making primary raw materials, the number of employes is not expected to be large.

Distributes Nylon Cord Kit

A pocket-size kit for demonstrating the properties of nylon tire cord was distributed by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., to more than 4,000 tire dealers at the annual convention of the National Association of Independent Tire Dealers, October 9-12, in New York, N. Y.

Designed to assist the tire dealer in selling nylon cord tires, the kit has demonstrations illustrating the superior impact, flexing, and moisture resistance of nylon cord compared to conventional cord.

Kenton Bows in Hooker-Durez Plastics Plant

Hooker Electrochemical Co., Niagara Falls, N. Y., and its Durez Plastics Division were honored by the city of Kenton, O., on a specially declared Hooker-Durez Day, October 13, in celebration of the official opening of the new $5,000,000 Durez phenolic plastics molding compound plant in Kenton.

Sponsored by the Kenton Chamber of Commerce, the day's activities were highlighted by a luncheon at the city's Elks Club, which was addressed by state and city officials, as well as company executives, including R. Lindley Murray, Hooker's chairman of the board, and John F. Snyder, Sr., a Hooker vice president.

The new plant, whose buildings occupy 15 acres of land, remained open to visitors throughout the day. Notable feature of the plant's design is a series of large control panel boards which provide a high degree of automation in the production of Durez granular black molding compounds.

Served by three railroad systems and having access to seven national and state highways, the Kenton plant is supplied with raw materials, such as phenol and formaldehyde, from the company's North Tonawanda, N. Y., facilities.

The Durez compounds are molded into such consumer and industrial products as camera and instrument cases, radio cabinets, telephone handsets, utensil handles, wall-switch plates, light plugs, and automobile distributor caps, the company reports.

Celanese Expands Labs In Charlotte, N. C.

Celanese Corp. of America, according to K. C. Loughlin, vice president and general manager, is adding to its applications and product development laboratories at Charlotte, N. C., to give the marketing department of its textile division "the most complete development laboratories ever attached to a textile industry marketing operation."

The move is being effected by a consolidation of sales personnel and technical service facilities drawn from company operations in New York, N. Y.; Summit, N. J.; Hopewell, Va.; and Burlington, N. C., with those already in Charlotte.

In his announcement Mr. Loughlin said the organization would undertake a wide range of technical service projects. For example,

"In many fields—such as mechanical rubber goods, plastics laminates, military, aircraft, and automobile applications—detailed information on chemical, physical, or electrical characteristics of yarn [such as, Fortisan 36] will be developed to speed up customer research work."

John W. Brooks, director of textile marketing, will make his headquarters at Charlotte as head of the entire Celanese textile marketing organization. Reiner G. Stoll will be in charge of the applications and product development laboratories; while R. D. Williams, business manager, will coordinate the physical aspects of the new development laboratories.

Martin Tours U. S. Industry for NRB

George Martin, for many years superintendent for the London Advisory Committee for Rubber Research (Ceylon and Malaya) and Colwyn Gold Medalist of the Institution of the Rubber Industry, completed a tour of American rubber goods manufacturing plants in late October for the Natural Rubber Bureau and the natural rubber producing industry it represents. He sailed on October 25 for England, where he will report the results of his trip to the British Rubber Development Board and the British Rubber Producers' Research Association.

Mr. Martin, who met with representatives of the American consuming industry in New York, Boston, Trenton, Akron, Buffalo, Chicago, Los Angeles, San Francisco, Denver and St. Louis explored the advisability of setting up in this country a technical liaison service that would work with manufacturers on problems having to do with the use of natural rubber.

He also described to American research executives a number of new technical advances that have been developed in the laboratories of the natural rubber producing industry. Martin discussed such recent developments as Heveaplus, graft polymers, cyclized rubber masterbatches, lignin masterbatches, and similar materials. A good deal of interest was evidenced in samples of a superior processing rubber exhibited by Mr. Martin. This new-type natural rubber is said to have exceptional extrusion characteristics and low shrinkage performance.

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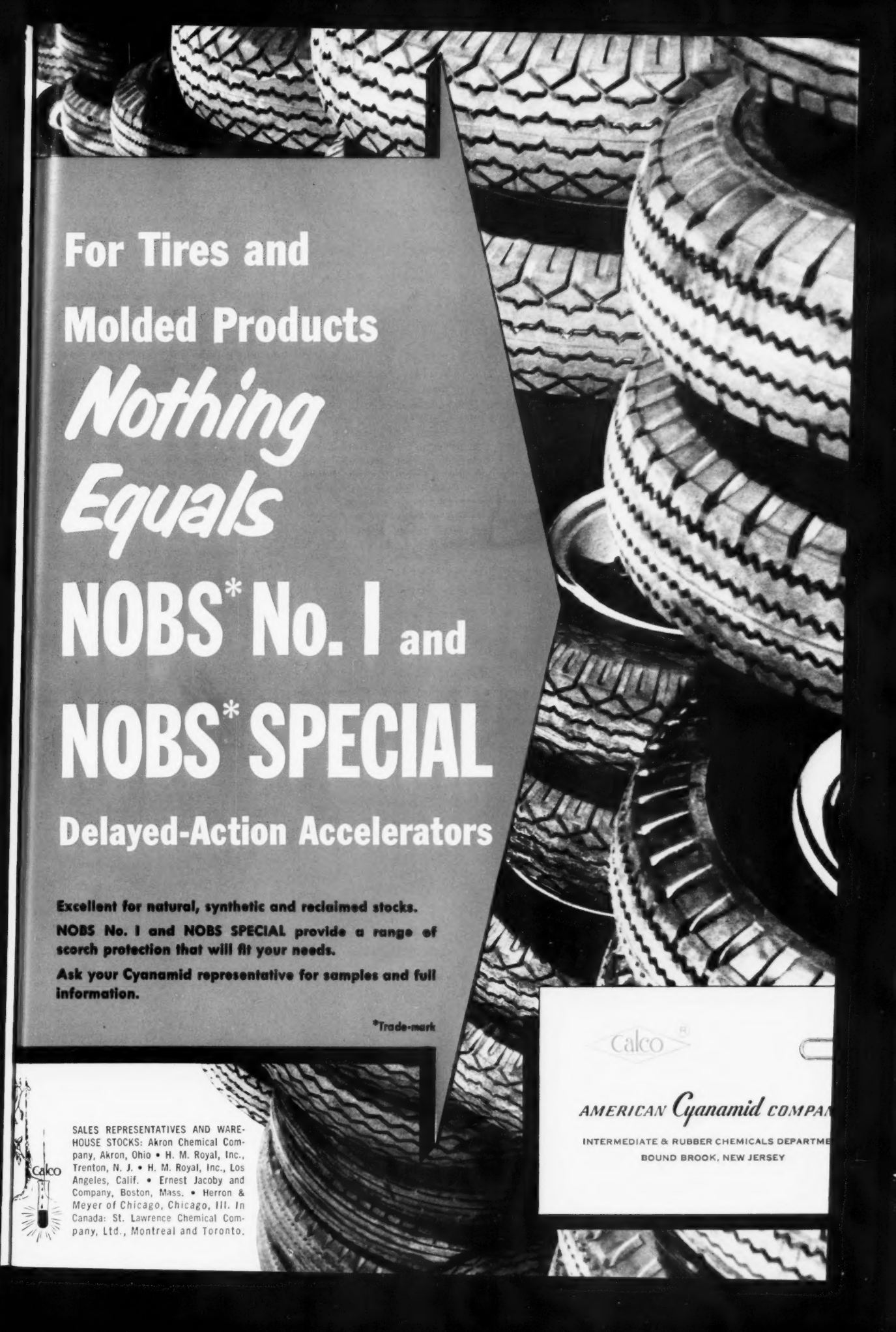

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News about People

Dale Strasser now is materials handling engineer for Witco Chemical Co., New York, N. Y. In his new capacity in the rubber chemicals department in Akron, O., Mr. Strasser is available to rubber, ink, and other industries for consultation on problems relating to carbon black packaging, storage, and transportation. He formerly was on the staff of the Witco-associated Continental Carbon Co. in Amarillo, Tex., where he was responsible for engineering details of carbon black packaging, unit loading, and shipping as well as pilot plants and production.

Kenneth L. Isaacs, vice chairman of the Trustees of Massachusetts Investors Trust, has been elected a director of New Jersey Zinc Co., New York, N. Y.

Aser R. Nurmi has been advanced to production superintendent of the Covington, Va., rayon plant of Industrial Rayon Corp., Cleveland, O., replacing **James W. Coleman,** promoted to plant manager.

Tom Sloan, C. E. Schermerhorn, and **Howard Keefer** have joined California Rubber Products, Inc., Los Angeles, Calif., as sales manager, production manager, and manager of rubber plant production, respectively.

D. L. Matthews has been appointed chief engineer of Goodrich-Gulf Chemicals, Inc., Cleveland, O. He was formerly general chemicals plant manager at Avon Lake, O., for B. F. Goodrich Chemical Co. and supervised a plastics plant expansion for British Geon, Ltd.

Frank Sherry has been appointed manager of the Newcomerstown, O., plastics division plant of Seiberling Rubber Co., Akron, O., succeeding **C. F. Biggs,** who has been returned to the firm's main factory on special assignment in the office of the production superintendent.

J. W. Kaine, industrial textile division representative for Callaway Mills, Inc., New York, N. Y., has been promoted to the rank of Brigadier General in the United States Army Reserve.

D. B. Benedict has been named a vice president of Carbide & Carbon Chemicals Co., division of Union Carbide & Carbon Corp., New York, N. Y., and will be responsible for research and development on synthetic fibers, as well as other fields.

William A. Fairclough has been appointed assistant manager, rubber chemical sales, Naugatuck Chemical, division of United States Rubber Co., Naugatuck, Conn. His successor, as technical representative, West Coast area, is **C. M. Churchill.**

W. C. Douce, J. T. Roach, R. G. Askew, and **C. R. Scott** have been named district managers, plastic sales division, of Phillips Petroleum Co., Bartlesville, Okla., in New York, Chicago, Los Angeles, and Boston, respectively. **W. R. Barrett** and **G. F. Blinzler** have been appointed sales engineers in the division for the Boston and Chicago district offices, respectively. Other appointments to the division include **M. W. Davidson,** to supervisor of the sales service and development branch in the Bartlesville office; and **L. B. Croley, J. V. Smith,** and **A. L. Walters,** to sales service engineers in that branch.

Paul C. Zellers has been named supervisor of wage and salary administration for The B. F. Goodrich Co. Industrial Products Division, Akron, O.

Gordon Ault has been advanced to assistant district manager of the San Francisco district of Carbide & Carbon Chemicals Co., division of Union Carbide & Carbon Corp., New York, N. Y.

Eugene A. Krouse has joined Thiokol Chemical Corp., N. J., as technical representative.

Eugene A. Krouse

Wayne Herkness II has been named vice president of United Carbon Co., Inc., and will have charge of the company's foreign operations. This company is the carbon black manufacturing and sales subsidiary of United Carbon Co., Charleston, W. Va. With United Carbon since 1951, Mr. Herkness formerly was with Charles Eneu Johnson Co., Inc., another United Carbon Co. subsidiary. Mr. Herkness will make his headquarters at Charleston, but will spend much time overseas in connection with company sales and plant operations.

Willis M. Cooper has been made assistant general manager of the research and engineering division of Monsanto Chemical Co., St. Louis, Mo., and will be responsible for the engineering activities of the division. He has been with the company since 1935, most recently as director of the division's engineering section.

Edwin J. Thomas, president, The Goodyear Tire & Rubber Co., and **Kelly Y. Siddall,** vice president, The Procter & Gamble Co., Cincinnati, O., have been elected to the board of directors of The Procter & Gamble Co.

Joseph Anastasio has been appointed sales manager for United States Rubber Co., of U. S. Carpet Cushion and other sponge-rubber underlays for carpets sold through distributors. He will make his headquarters at Naugatuck, Conn., in the company's footwear plant where the products are made. Mr. Anastasio has been with the company since 1947, mostly in sales capacities.

E. M. Katt has been appointed to the bench-scale piloting section of The Goodyear Tire & Rubber Co.'s research division, Akron, O.

Paul Bogner has been appointed to the Chicago district sales office of Emery Industries, Inc., Cincinnati, O.

Paul Bogner

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Eligio J. Caire

Eligio J. Caire has joined Thiokol Chemical Corp., Trenton, N. J., as technical sales representative.

John Rauch and **Norman Sellers** have been added to the sales staff of Naugatuck Chemical division, United States Rubber Co., New York, N. Y.

R. Arthur Gaiser has joined Ball Bros. Co., Inc., Muncie, Ind., as director of research and product development. He was formerly a researcher for Libbey-Owens-Ford Glass Co.

J. C. Graden, former industrial products development engineer for The Goodyear Tire & Rubber Co., has been appointed manager of technical service and design of industrial products at the Goodyear-Oxo factory near Mexico City, Mexico.

Howard Fisher, assistant chief chemist, W. J. Voit Rubber Corp., Los Angeles, Calif., has been advanced to chief chemist, sporting goods division; while **Ford Price** has been promoted to chief development compounder.

John W. Church has been named vice president in charge of research and development of Mastic Tile Corp. of America, New York, N. Y., and will head an expanded research program including new product development in the building material field, quality control, and process and product improvement.

William D. Croswhite, Sr. has been named plant manager of Industrial Rayon Corp.'s Painesville, O., plant, one of the world's largest facilities for making rayon tire yarn, cord, and fabric. Mr. Croswhite, formerly plant manager at the company's rayon and nylon facilities at Covington, Va., succeeds the late **Fred E. Palmer.** Mr. Croswhite's successor at Covington is **James W. Coleman,** previously production superintendent at the plant.

James F. Hand, manager of rubber chemical sales for Monsanto Chemical Co.'s organic chemicals division, recently completed 25 years with the company. All this time has been spent with Monsanto's rubber chemicals department at Akron, O., providing technical and sales service to the rubber industry.

Dilmas V. Fitz and **H. A. Harrison** have been advanced to general superintendent and production superintendent, respectively, for Petro-Tex Chemical Corp., Houston, Tex., producer of butadiene. Also advanced were **C. Herbert Sloan,** to process superintendent, and **Walter A. Myrick, III,** to administrative assistant.

Roger S. Firestone, president of The Firestone Plastics Co., Pottstown, Pa., has been elected a vice president of the new Research & Educational Foundation established by United Cerebral Palsy and a group of industrialists. Mr. Firestone is also national campaign chairman for UCP.

E. W. Baumgardner has been named sales manager of Trabon Engineering Corp., Cleveland, O., and will supervise national and international sales of Trabon centralized automatic lubrication systems. Mr. Baumgardner formerly was with Industrial Ovens, Inc., having served as chief engineer and then as sales manager.

Joseph Dec has been assigned to the newly created post of assistant manager in the paper and organic products department at Johns-Manville Research Center, Manville, N. J. This promotion results from an expansion in the scope of the department, with the formation of a new tapes and adhesives section. Dr. Dec came to J-M in 1946 to head the organic chemistry section, now known as organic specialties, which he will continue to supervise.

Paul T. Keppler, a veteran in the tire recapping industry, has been named sales representative for the camelback division of W. J. Voit Rubber Corp., Los Angeles, Calif. The firm's camelback and tire repair materials plant is in Portland, Oreg., but Mr. Keppler will make his headquarters in Spokane, Wash., and will cover eastern Washington, eastern Oregon, and western Idaho.

Arthur John Hocking has been appointed manager of advertising and sales promotion for the footwear and general products division of United States Rubber Co., New York, N. Y.

Willfred W. Lufkin, Jr., for the past three years president of Wellington Sears Co., has joined Celanese Corp. of America, New York, N. Y., as a vice president and as president of its foreign trading subsidiaries. He will make his headquarters in the Celanese offices at 180 Madison Ave., but will travel extensively throughout Europe, South America, and the Far East.

Richard N. Comes has been appointed manager of Banbury mixer sales for Farrel-Birmingham Co., Inc., Ansonia, Conn., and has been succeeded as field sales engineer in New England by **Richard D. Mace,** who now will handle the sale of F-B rubber and plastics processing machinery in this territory. Mr. Comes, who started with the company in 1951 as a student engineer, has served successively as technical assistant, sales engineer, and field sales engineer. Mr. Mace, who began as a patternmaker apprentice in the company's foundries in 1923, most recently was assistant superintendent of foundries.

Lane L. Bonner, Jr., has joined the polychemicals division, West Virginia Pulp & Paper Co., Charleston, A. S. C., as a technical sales representative. This division manufactures and markets pine wood lignin and its derivatives under the registered trade names, Indulin, Polyfon, Politol, and Polypol. These materials are used as surfactants, extenders, binders, stabilizers, and sequestrants in many chemical process industries.

LeRoy Staunton has been appointed sales manager of Uskon radiant heating panels for United States Rubber Co., New York, N. Y. Before joining the company he was a private management counsel specializing in new product development and sales.

D. E. Lintala has been advanced to the organic research department of Goodyear Tire & Rubber Co., Akron, O. Mr. Lintala, with the company since 1942, had been working in the chemical engineering department.

A. G. Susie has been named technical superintendent for the Baytown, Tex., synthetic rubber plant of United Rubber & Chemical Co., subsidiary of United Carbon Co., Charleston, W. Va. He was formerly United Carbon's superintendent of research at its executive headquarters.

A. G. Susie

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Vincent V. Tivy has been advanced to chief application engineer for Foxboro Co., Foxboro, Mass., and will serve on the firm's engineering executive and sales product committees.

William C. Scheuermann is now with Bettis Rubber Co., Whittier, Calif., as chief chemist.

George A. Sackett, a 33-year veteran of the rubber industry, has been appointed director of repair material development for Armstrong Rubber Co., West Haven, Conn.

Kornelijs Dinbergs has joined the staff of The B. F. Goodrich Co. Research Center, Brecksville, O., as chemist.

Robert Youmans has joined Los Angeles Standard Rubber Co., Los Angeles, Calif. He was formerly associated with R. T. Vanderbilt Co. and Kirkhill Rubber Co.

Charles F. Fuchs, vice president and technical director of Emulsol Chemical Corp., Chicago, Ill., has been elected a member of the firm's board of directors.

Walt Westman has been named chief chemist of Rubber Corp. of California, Garden Grove, Calif.

Earle T. Runcie, formerly special assistant to the executive vice president and manager of the oil and gas divisions of Continental Carbon Co., has been appointed director of purchases for Witco Chemical Co., New York, N. Y.

Charles H. Churchill has become associated with American Latex Products Corp., Hawthorne, Calif., in a managerial capacity.

The B. F. Goodrich Co. Research Center, Brecksville, O., has added the following to its staff: **Wilkinson W. Meeks,** as a senior technical man; and **Hans R. Voelkl** and **Elmer J. DeWitt,** as research chemists.

The Mansfield Tire & Rubber Co., Mansfield, O., last month announced departmental changes involving promotions and newly created positions in its sales, engineering, and research and development departments. **John W. Hammer,** assistant advertising manager in the sales department, has been elevated to advertising and sales promotion manager, succeeding **William A. LaValley,** who recently became West Coast division sales manager, with headquarters at Oswego, Oreg. Manager of interplant relations, a new position in the research and development department, is **Thomas R. Williams. Robert M. Kallgren** has been made plant engineer in the office of **Paul C. Taylor,** director of engineering, and will be in charge of design and layout work for the Mansfield and associated companies.

Jerome H. Fritz Studio

J. Robert Keach

J. Robert Keach, manager of the industrial rubber sales division of Thermoid Co., Trenton, N. J., has been elected a vice president of the firm. A 30-year veteran of the rubber industry, he was formerly vice president and general manager of Quaker Rubber Co. and general plant manager of The Firestone Tire & Rubber Co.'s industrial rubber division.

P. A. Uva has been advanced to chief chemist of Avon Sole Co., Boston, Mass., replacing **Laurence C. Shaw,** who has retired after 42 years of service with the company. Also advanced were **John P. Nolan,** to laboratory manager and plant chemist, and **William J. Perkins,** to development chemist.

Donald J. Molenaur and **J. D. Hauenstein** have been named research assistant and research chemist, respectively, in the high polymer section, research division, The Goodyear Tire & Rubber Co., Akron, O.

News Briefs

Phillips Petroleum Co., Akron, O., rubber chemicals division, has moved its eastern district sales office to 634 Hospital Trust Bldg., Providence 3, R. I. R. B. Robitaille is manager.

Hewitt-Robins, Inc., Stamford, Conn., has completed a 6,800-square-foot addition to its Fremont, O., plant, where die-cut foam-on-fabric for the automobile trade is produced.

The General Tire & Rubber Co. and **The Goodyear Tire & Rubber Co.,** both of Akron, O., **International Latex Corp.,** Dover, Del., and **United States Rubber Co.,** New York, N. Y., will participate in a Pageant of Industrial Progress, November 8-10, in celebration of the fiftieth anniversary of Chicago's Central Manufacturing District.

Argus Chemical Corp., Brooklyn, N. Y., has established warehouse facilities in Akron, O., the first of what is expected to be a series of nation-wide warehouses.

Sierra Rubber Co., Los Angeles, Calif., has added a new building, new extruder, and new 60-inch mill to its present facilities.

Chemical & Process Machinery Corp. has moved its offices from New York, N. Y., to 52 Ninth St., Brooklyn, N. Y.

The Timken Roller Bearing Co., Canton, O., has organized a sales forecast department for the purpose of making available to management long-term forecasts of sales activity so that budget control programs, inventory levels, and employment stabilization may be planned in advance. Robert E. Wagenhals has been named manager of the new department.

H. Maimin Co., Inc., New York, N. Y., manufacturer of cutting machines and cloth drills, has appointed the Atlantic office of Cutters Exchange, Nashville, Tenn., distributor for Maimin products in Georgia, Alabama, and Florida north of Jacksonville. This distributing office, at 338 Peachtree St., N.E., Atlanta, Ga., will carry a complete stock of spare parts for the convenience of Maimin users, and its staff will sell and service Maimin products.

Stauffer Chemical Co., New York, N. Y., plans construction of a multi-million-dollar petrochemical plant at Louisville, Ky., for the production of carbon tetrachloride, chloroform, methylene chloride, and anhydrous hydrogen chloride. This new plant will be adjacent to Stauffer's existing Louisville plant, which currently produces carbon tetrachloride, perchlorethylene, anhydrous hydrogen chloride, and Acritet Grain Fumigant. Structural and process engineering are now in progress. The plant, construction of which will start early next year, will be ready for operations in 1957.

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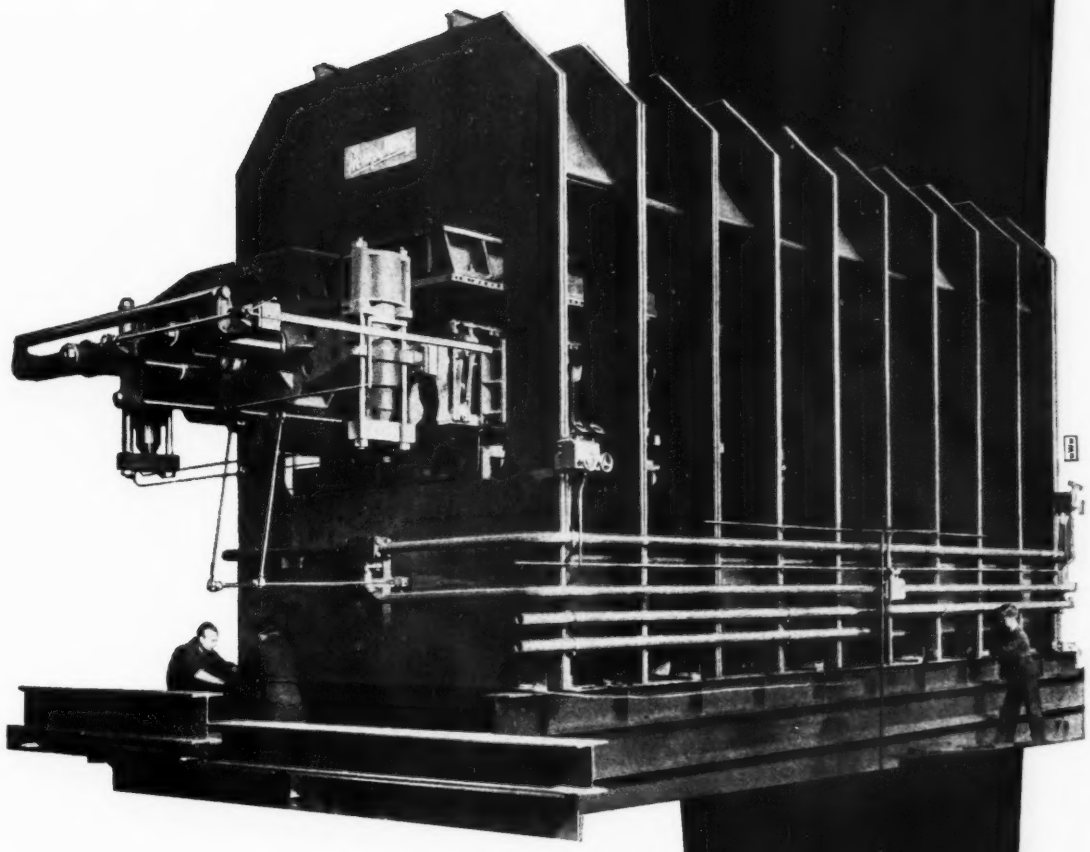

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Goodrich-Gulf Chemicals, Inc., Cleveland, O., through W. I. Burt, president, has announced that construction has begun on a pilot plant at Avon Lake, O., for the production of synthesized natural rubber. The facility is expected to be in operation some time in 1956. The company recently revealed that large truck tires made of the new rubber have been giving road service and mileage comparable to similar tires made of tree-grown rubber.

Carbide & Carbon Chemicals Co., a division of Union Carbide & Carbon Corp., New York, N. Y., has opened its twenty-sixth sales office, at 233 St. Maurice Ave., New Orleans 17, La. J. T. Fox has been named technical representative there.

Pelron Corp., Lyons, Ill., has begun production of polyurethane resins and foam materials after some two years of research and development work, according to Paul E. Pelletier, president. Rigid and foam end-products made of the polyurethanes are known for their high insulation properties, light weight, extremely good adhesive strength, and ease of preparation, the company executive said.

Wellco-Ro-Search, Waynesville, N. C., has revealed that increased orders for Foamtread footwear from Wellco Shoe Corp. have necessitated a 20% increase in production and the institution of a 48-hour work-week instead of the normal 40 hours.

Monsanto Chemical Co., St. Louis, Mo., has absorbed Lion Oil Co., El Dorado, Ark., with 1½ shares of Monsanto $2 par value common stock being exchanged for each outstanding share of Lion stock. Lion will be a division of Monsanto.

United States Rubber Co., New York, N. Y., will for the first time make available tubeless models in its second-line tire, the U. S. Royal Air Ride. Sizes will be 6.70-15, 7.10-15, and 7.60-15.

Petro-Tex Chemical Corp., Houston, Tex., is constructing new facilities which will boost by 50% its butadiene production, according to Gardiner Symonds, chairman, and Paul L. Davies, president. The plant now has a capacity of 90,000 short tons a year. Described as the first step in the company's plans for expansion in the petrochemical field, the added facilities are expected to be in operation by the end of 1956.

Kentucky Color & Chemical Co., Louisville, Ky., is now in production on a new color series, Cadmium Lithopone Yellows, in primrose, lemon, and medium shades. According to the company, the pigments are heat and light stable and resistant to alkalies and are adapted to the production of heat-resistant enamels, emulsion paints, leather finishes, tin printing inks, and plastic goods of all types.

Financial

Allied Chemical & Dye Corp., New York, N. Y. Nine months ended September 30, 1955: consolidated net income, $39,376,583, equal to $4.32 a common share, compared with $31,915,511, or $3.57 a share, in the same months last year; sales, $475,415,566, against $399,414,436.

American Cyanamid Co., New York, N. Y., and wholly owned subsidiaries. First nine months, 1955: net consolidated earnings, $25,574,350, equal to $2.89 each on 8,837,245 common shares, compared with $19,960,630, or $2.29 each on 8,722,921 shares, in the same months last year; net sales, $336,267,690, against $293,326,188.

American Hard Rubber Co., New York, N. Y. Thirty-six weeks to September 11, 1955: net earnings, $482,505, equal to $1.42 a share, against $328,328, or 88¢ a share, in the 1954 period.

Boston Woven Hose & Rubber Co., Cambridge, Mass. Year ended August 31, 1955: net income, $287,242, equal to 71¢ each on 344,000 common shares, contrasted with net loss of $432,005 in the preceding fiscal year; provision for income taxes, $259,000, against $0; net sales, $16,326,608, against $15,259,855; current assets, $7,082,366, current liabilities, $1,661,231, against $7,034,028 and $817,647, respectively, on August 31, 1954.

Collins & Aikman Corp., New York, N. Y. Six months ended August 27, 1955: net profit, $551,442, contrasted with net loss of $1,052,198 in the 1954 months.

Dow Chemical Corp., Midland, Mich., and subsidiaries. Quarter ended August 31, 1955: net income, $11,723,647, equal to 51¢ each on 22,778,324 common shares, compared with $8,544,028, or 36¢ each on 22,651,010 shares, in the 1954 quarter; net sales, $128,166,671, against $107,822,510.

The Eagle-Picher Co., Cincinnati, O., and subsidiaries. Nine months ended August 31, 1955: consolidated net income, $3,325,343, or $3.36 each on 989,177 capital shares, contrasted with $1,227,610, or $1.24 a share, in the 1954 period; net sales, $83,645,527, against $56,133,885.

The General Tire & Rubber Co., Akron, O., and subsidiaries. Nine months ended August 31, 1955: net earnings, $6,874,268, equal to $4.90 each on 1,244,423 common shares, compared with $4,427,452, or $3.26 each on 1,223,220 shares, a year earlier; net sales, $209,808,056, against $154,962,719.

Diamond Alkali Co., Cleveland, O. First three quarters, 1955: net profit, $6,255,846, equal to $2.58 each on 2,270,393 common shares, contrasted with $4,477,861, or $1.80 a share, in the 1954 period; net sales, $82,888,247, against $70,988,638.

Electric Hose & Rubber Co., Wilmington, Del. Year ended August 31, 1955: net income, $1,075,761, equal to $3.73 a common share, contrasted with $449,085, or $1.56 a share, in the preceding fiscal year; net sales, $16,189,655, against $12,382,755.

General Electric Co., Schenectady, N. Y. Nine months ended September 30, 1955: net earnings, $141,359,000, equal to $1.63 a share, against $136,191,000, or $1.57 a share, in the same period of 1954; sales, $2,245,958,000, against $2,167,397,000.

Hercules Powder Co., Wilmington, Del., and subsidiaries. First nine months, 1955: net profit, $14,254,462, equal to $5.18 a common share, compared with $10,763,468, or $3.89 a share, a year earlier; sales, $169,791,798, against $140,191,466.

Johns-Manville Corp., New York, N. Y., and subsidiaries. Nine months ended September 30, 1955: net income, $16,441,242, equal to $5.16 each on 3,192,804 common shares, compared with $12,711,589, or $4.00 each on 3,178,913 shares, a year earlier; sales, $207,892,376, against $184,612,937.

Lee Rubber & Tire Corp., Conshohocken, Pa., and domestic subsidiaries. Nine months ended July 31, 1955: net profit, $1,142,408, equal to $1.34 a capital share, compared with $944,766, or $1.11 a share, a year earlier; sales, $31,566,448, against $27,885,394.

Mansfield Tire & Rubber Co., Mansfield, O. Initial half, 1955: net earnings, $993,668, equal to $1.74 a share, contrasted with $287,762, or 52¢ a share, in last year's half; sales, $38,468,754, against $24,984,955.

O'Sullivan Rubber Corp., Winchester, Va. Six months ended June 30, 1955: net profit, $42,164, equal to 6¢ a share, against $39,387, or 6¢ a share, in the same months of 1954.

Phelps Dodge Corp., New York, N. Y. First half, 1955: net profit, $33,458,915, equal to $3.30 a share, compared with $29,061,740, or $1.98 a share, a year earlier.

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Minnesota Mining & Mfg. Co., St. Paul, Minn., and domestic and Canadian subsidiaries. Half ended June 30, 1955: net earnings, $15,781,268, equal to $1.92 each on 8,221,554 common shares, compared with $11,453,133, or $1.39 each on 8,218,985 shares, in the corresponding half last year; net sales, $131,645,501, against $111,874,966.

Monsanto Chemical Co., St. Louis, Mo., and consolidated subsidiaries. Nine months to September 30, 1955: net earnings, $23,581,647, equal to $1.45 a common share, compared with $16,635,642, or $1.02 a share, in the like period last year; sales, $307,679,198, against $252,636,332.

National Motor Bearing Co., Inc., Redwood City, Calif. June half, 1955: net earnings, $322,042, equal to 76¢ a share, compared with $500,706, or $1.18 a share, a year earlier; net sales, $9,057,657, against $7,986,528.

National Rubber Machinery Co., Akron, O. Initial half, 1955: net profit $314,919, equal to $1.61 each on 195,556 capital shares, contrasted with $430,401, or $2.20 a share, in the '54 half; sales, $5,882,481, against $5,431,000.

The New Jersey Zinc Co., New York, N. Y., and subsidiaries. First half, 1955: net profit, $2,563,691, equal to $1.31 each on 1,960,000 shares contrasted with $1,723,279, or 88¢ a share, in the 1954 half; sales, $10,066,382, against $6,323,115.

Parke, Davis & Co., Detroit, Mich. January 1-September 30, 1955: net earnings, $9,528,480, equal to $1.94 a share, against $7,052,264, or $1.44 a share, in the 1954 months.

Phillips Petroleum Co., Bartlesville, Okla., and subsidiaries. First half, 1955: net profit, $42,575,770, equal to $2.80 each on 15,187,223 shares, compared with $37,918,723, or $2.59 each on 14,636,099 shares, in last year's half.

First nine months, net profit, $65,189,370, equal to $3.80 each on 17,137,510 shares, against $55,614,539, or $3.80 each on 14,646,530 shares, a year earlier.

Raybestos-Manhattan, Inc., Passaic, N. J., and domestic subsidiaries. First half, 1955: net profit, $1,988,473, equal to $3.16 each on 628,100 capital shares, compared with $1,221,769, or $1.94 a share, in the first half of 1954.

Rome Cable Corp., Rome, N. Y. Second quarter, 1955: net profit, $380,000, equal to 74¢ each on 513,112 capital shares, contrasted with $235,000 or 47¢ each on 499,425 shares, in the '54 quarter.

U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y. Nine months to September 30, 1955: net profit, $270,967, contrasted with net loss of $161,052 in the same period last year.

Plymouth Rubber Co., Canton, Mass. Six months ended May 28, 1955: net income, $312,422, equal to 35¢ a share, contrasted with $160,097, or 18¢ a share, a year earlier.

H. K. Porter Co., Inc., Pittsburgh, Pa., and subsidiaries. June half, 1955: net income, $1,994,325, equal to $1.92 each on 1,038,600 common shares, compared with $1,116,037, or $1.05 a share, in the 1954 half; net sales, $47,690,024, against $32,447,304.

Seiberling Rubber Co., Barberton, O. June half, 1955: net profit, $450,407, equal to 89¢ each on 391,430 common shares, contrasted with $161,097, or 14¢ a share, in the like period last year; net sales, $21,491,511, against $17,438,694.

Skelly Oil Co., Kansas City, Mo. Six months to June 30, 1955: net income, $14,823,411, equal to $2.57 each on 5,746,117 capital shares, against $14,183,889, equal to $2.46 a share, in the corresponding period in 1954.

Stauffer Chemical Co., New York, N. Y. January 1-September 30, 1955: net earnings, $6,475,000, equal to $2.75 a share, compared with $4,508,000, or $1.92 a share, a year earlier; net sales, $79,704,000, against $64,174,000.

Thermoid Co., Trenton, N. J. First three quarters, 1955: net income, $1,085,938, equal to $1.25 a share, contrasted with $614,983, or 66¢ a share, a year earlier.

Thiokol Chemical Corp., Trenton, N. J. Nine months ended September 30, 1955: net earnings, $395,211, equal to $1.09 each on 362,850 capital shares, compared with $188,483, or 56¢ each on 334,119 shares, in the like period of 1954.

Timken Roller Bearing Co., Canton, O. Six months to June 30, 1955: net profit, $11,306,029, equal to $4.67 each on 2,421,380 capital shares, contrasted with $5,976,249, or $2.47 a share, in the same months last year.

Union Asbestos & Rubber Co., Chicago, Ill. First six months, 1955; net loss, $2,256, contrasted with net profit of $291,119 in the same period last year; net sales, $7,044,861, against $7,382,053.

United Elastic Corp., East Hampton, Mass., and wholly owned subsidiaries. Half ended June 30, 1955: net profit, $821,310, equal to $3.04 each on 270,594 capital shares; net sales, $10,396,095.

United Carbon Co., Charleston, W. Va., and subsidiaries. Six months to June 30, 1955: net income, $2,510,138, equal to $2.10 a capital share, compared with $2,008,386, or $1.68 a share, in the 1954 half; net sales, $19,687,915, against $17,086,626.

Union Carbide & Carbon Corp., New York, N. Y. First three quarters, 1955: net profit, $101,436,489, equal to $3.48 each on 29,126,619 capital shares, compared with $63,145,879, or $2.18 each on 28,952,794 shares, in the corresponding months of 1955; sales, $857,123,236, against $667,143,639.

United Engineering & Foundry Co., Pittsburgh, Pa., and subsidiaries. January 1-June 30, 1955: net profit, $1,183,589, equal to 47¢ each on 2,462,238 common shares, against $1,486,958, or 59¢ a share, in the '54 months; net sales, $23,270,386, against $27,246,531.

United States Rubber Co., New York, N. Y. Initial half, 1955: net earnings, $19,005,463, equal to $3.09 a common share, contrasted with $14,442,587, or $2.23 a share, a year earlier; net sales, $457,039,061, against $392,575,337.

First nine months, 1955: net profit, $22,290,861, equal to $3.47 a share, against $20,084,571, or $3.05 a share, in the 1954 period; net sales, $688,775,620, against $587,269,614.

West Virginia Pulp & Paper Co., Charleston A. S. C. Nine months to July 31, 1955: net earnings, $9,138,000, equal to $1.79 a share, compared with $11,138,000, or $2.18 a share, in the 1954 period.

Westinghouse Air Brake Co., Wilmerding, Pa. First nine months, 1955: net income, $5,009,157 equal to $1.21 a common share, contrasted with $2,480,253, or 60¢ a share, in the corresponding months last year.

OBITUARY

Charles L. Fulkert

Charles L. Fulkert, who retired last year as vice president and director of Stokes Molded Products Division of Electric Storage Battery Co., Trenton, N. J., died October 10 in Trenton General Hospital. He was 71.

Mr. Fulkert became associated with Joseph Stokes Rubber Co., predecessor of Stokes Molded Products, as bookkeeper in 1902. Previously, after graduation from Stewart Business College, he had been with Munger Tire Co. and Joseph Ashton, Inc.

In 1938 he was named vice president of the Stokes firm and remained in charge of the sales department until 1946, when the company was sold to Electric Storage Battery Co. He served as vice president and director until his retirement.

He held memberships in the Carteret Club, Loyal Lodge 181, F&AM, Scottish Rite, Crescent Temple, Knights Templar, and Trenton Country Club, and was on the board of trustees of the Carolyn Stokes Day Nursery.

He is survived by a sister, a niece, and a nephew.

FARREL-BIRMINGHAM FLOOD REPORT

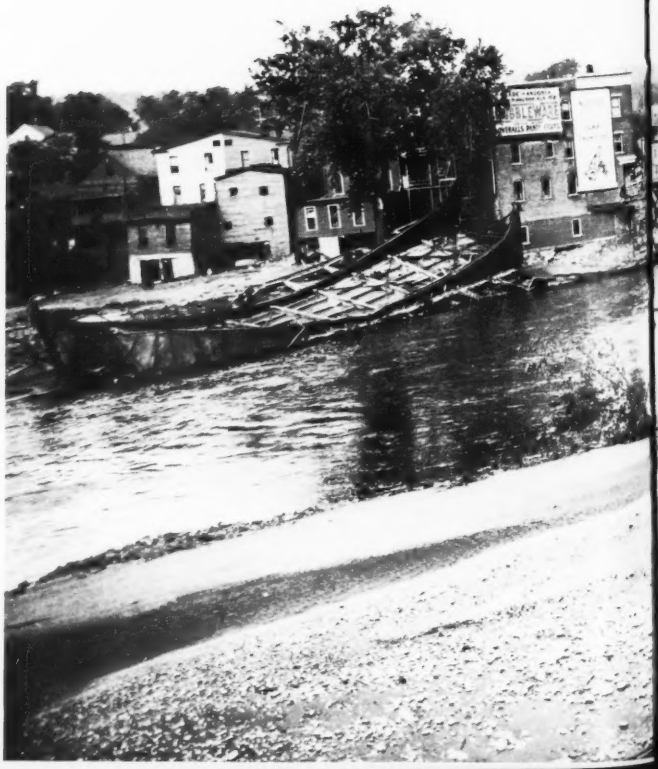
...came HEL

To get first-hand information to our customers, stockholders, employees and others interested in the welfare of the company, Farrel-Birmingham has hastened to prepare this brief flood report.

We were hard hit at our Ansonia and Derby plants but tremendous progress has been made in restoring facilities. The first step was cleaning up the mud from the flooded areas. This polluted stuff was two feet deep in some of the shops that were submerged and it was tough work. Heavy boots and gloves were available as early as 8:30 a.m. of the Saturday following flood day, and a stream of deliveries of raincoats, rain suits, all types of electric hand lamps, as well as shovels, pails, buckets, brooms and disinfectants followed. Also from the very start, on this same Saturday, our dispensary furnished typhoid shots to the workers. Safe water and food was provided, and then came power equipment in the kind of quantity that gave remarkable progress to the work. We were able to obtain portable generators, trucks, scoops, bulldozers, payloaders and mobile cranes, and delivery was very quick. Some generators were purchased outright. With daily emergency supervisors' meetings,

Above — Maple Street bridge just before being carried away by flood. The rushing waters lodged two box cars against pier at east end of bridge, and the vapor to the right of the tree is coming from one of them containing lime.

Right — Broken bridge section is shown as it was tossed upside down on the farther bank by torrential flood waters of the Naugatuck. Flash flood receded quickly but left terrible damage in its path, witness the destruction shown in this photograph.



EL nd HIGH WATER

effort was well coordinated and we all take a great deal of satisfaction in what was accomplished, especially in the first few days following the disaster.

The pictures on these pages can best indicate how Ansonia and Derby fared in this unprecedented Northeast flood disaster of August 19, 1955. Both cities were counted among the communities severely stricken in the Naugatuck Valley, but destruction was not as great as it was farther up the river.

At Derby, flood damage as a whole was less extensive than at Ansonia. At Ansonia, however, (where the river rose to a height of 43 feet — 10 feet above any previously recorded level), we were fortunate that our office, engineering department, foundry, main machine shop, and some other shops are on fairly high ground, and were undamaged.

Except for the praiseworthy recovery work of a great majority of company employees, Farrel-Birmingham's loss, which amounted to approximately $1,000,000 (not including loss of production), could easily have been doubled. To those who showed up at daybreak on Saturday following flood day to begin the cleanup job, we wish to pay a special tribute. These men really battled with the polluted muck at its worst.

We also extend grateful appreciation to Ansonia and Derby city officials, and to outside sources for splendid assistance — suppliers, for example, who rushed equipment and personnel to assist us in making an incredible recovery. Salvage in the erecting shop at Ansonia, which was under nine feet of water from the floor, and in the roll shop, where the water rose to a height of twelve feet, will run close to 100%.

To our customers, we want to report that as early as the first week following the flood we made a number of shipments of parts of machines on order to Rochester and Buffalo. Our plants in these cities have extensive facilities which are being used to help the Connecticut plants get back on schedule. We very much appreciate the tolerance you have shown in not pressing us for deliveries promised prior to the flood. We know how important delivery is to our customers and we are making every effort to increase production as conditions permit.

FRANKLIN FARREL, 3RD
President

Above — Aerial view showing Naugatuck River overflowing into Derby plant. At the height of the flood the water was 10½ feet deep in the machine shop.

Below — Mid-morning flood stage east of Ansonia erecting shop and in foundry materials storage yard.

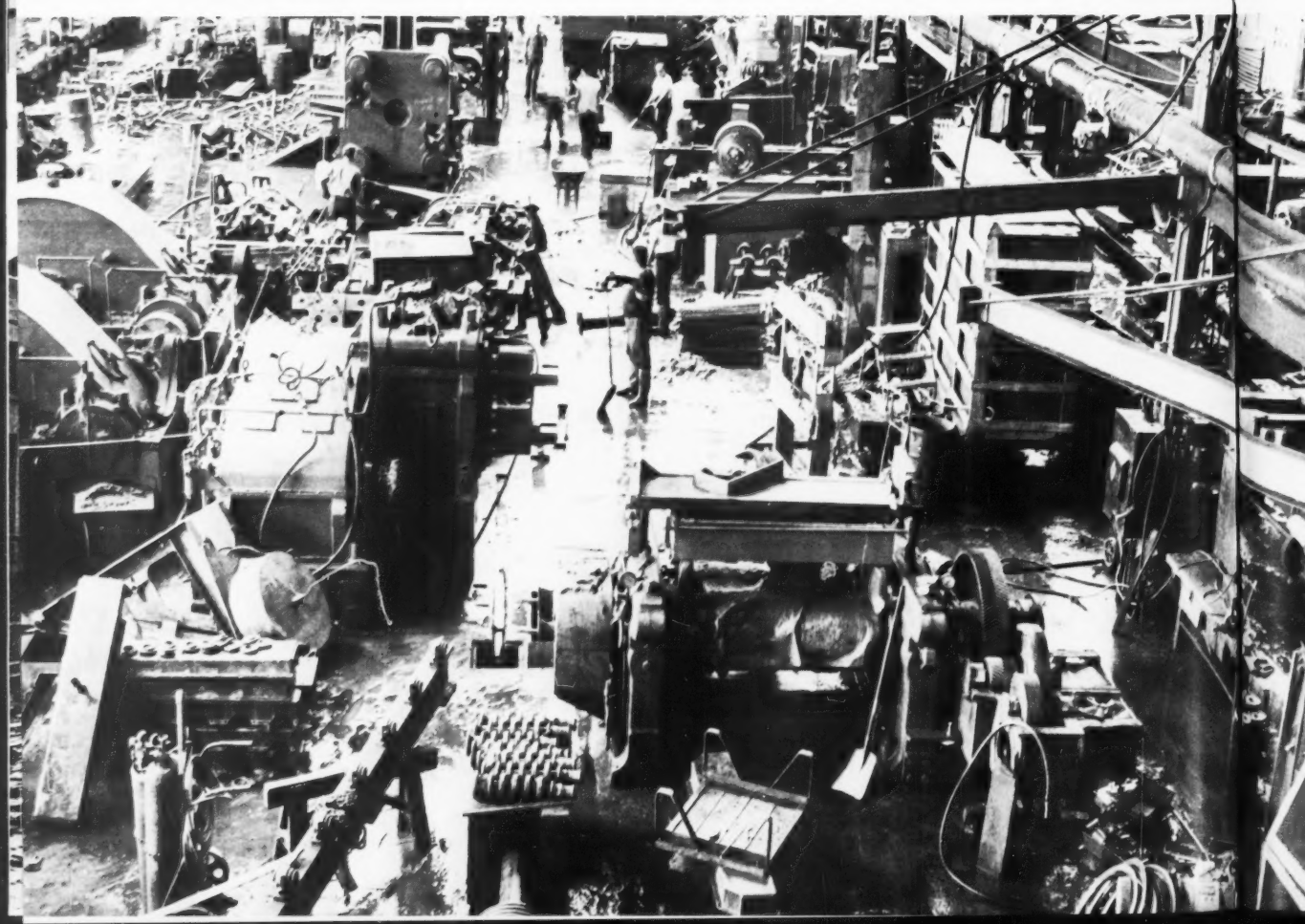
The morning of August 19th

Top Right — At Ansonia, the raging waters of the Naugatuck River are shown at midday of the 19th, shortly before the steel and concrete Maple Street bridge fell prey to the flood.

Right — Maple Street bridge after part of span over Naugatuck River had collapsed. The farther section followed soon after. That in the foreground, over the submerged New Haven railroad tracks, remained standing.

Bottom Right — The New Haven railroad tracks, which pass between the erecting shop on one side and the main machine and roll shops on the other, are here under several feet of water at 10 a.m. on Friday.

Below — The Naugatuck River entered the basements of these stores in the rear and gushed up through hatchways and coal holes into Main Street, just below the Ansonia plant.



Digging out the Erecting Shop

Upper Left — This shows the height which flood waters reached by mid-morning in the F-B erecting shop. The water rose about two feet more before receding.

Lower Left — By Sunday, with water receded, amazing cleanup progress had been accomplished. Over 900 Farrel men cooperated in the job of digging out of polluted muck and debris, with the use of auxiliary power only. Men worked waist-high in water to rush unassembled machine parts into antirust solvent. When water receded, parts, gears and bearings were then cleaned and given oil baths.

Top Right — Men at work removing steel bridge, washed down by the flood from a quarter mile upstream, so damaged wall of F-B erecting shop can be repaired and full crane service restored.

Middle Right — With arms sore from typhoid shots, crews hosed, scrubbed and shoveled to restore order; then they rehosed and scrubbed again. The work was continuous throughout the week. Aid from outside sources and equipment supply helped to make phenomenal recovery progress possible.

Bottom Right — Some of the thousands of small machine parts salvaged during the first week following the flood.

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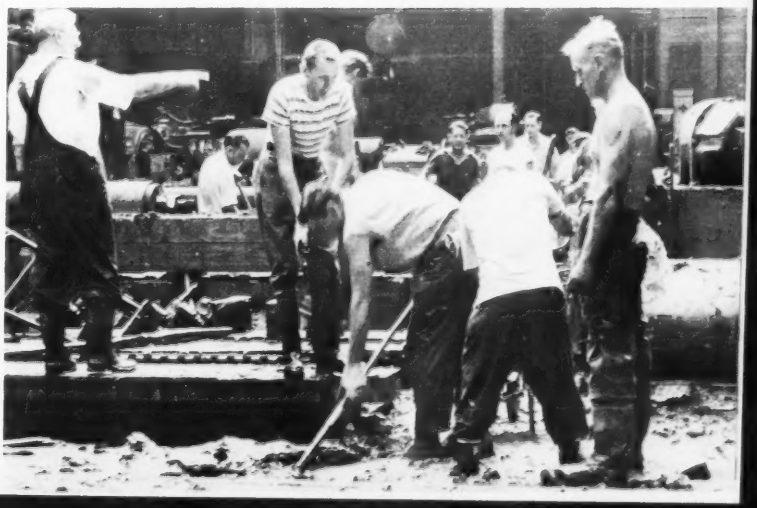
Order from chaos . . . the Roll Shop

Upper Left — By 10 a.m. of August 19th, machinery in the roll shop was submerged, with only a few overhead drive motors still showing.

Lower Left — By Monday noon, the third day after the flood, by tireless effort the muck had been cleaned out and order brought from chaos. With limited crane service, using auxiliary power, the large heavy-duty roll grinder (left foreground) had already been dismantled for cleaning and overhaul.

Top Right — At the height of the flood, the water came up to the crane runways in this roll shop bay.

Middle Right — Shipping bay and one end of main bay in the roll shop, where the water reached a height of twelve feet above the floor.



Bottom Right — Sixty men worked throughout the week to remove the two-foot depth of muck which the flood deposited in the roll shop.

Above — Three men, marooned in the Derby plant by rapidly rising flood waters, walk to safety over the aerial ladder of a Shelton Fire Department truck.—N.Y. Daily News Photo.

Below — At the Derby plant, the gatehouse was nearly submerged and the brick wall bordering Main Street collapsed.

Below — Yard at Derby plant under water.

When the flood hit Derby

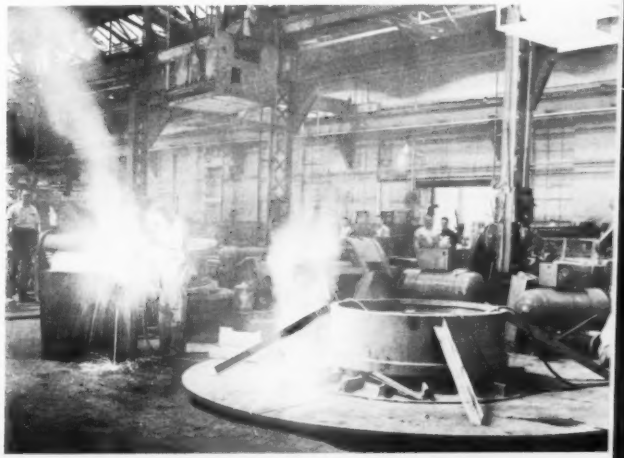
Top Right — Front yard at Derby plant after the flood.

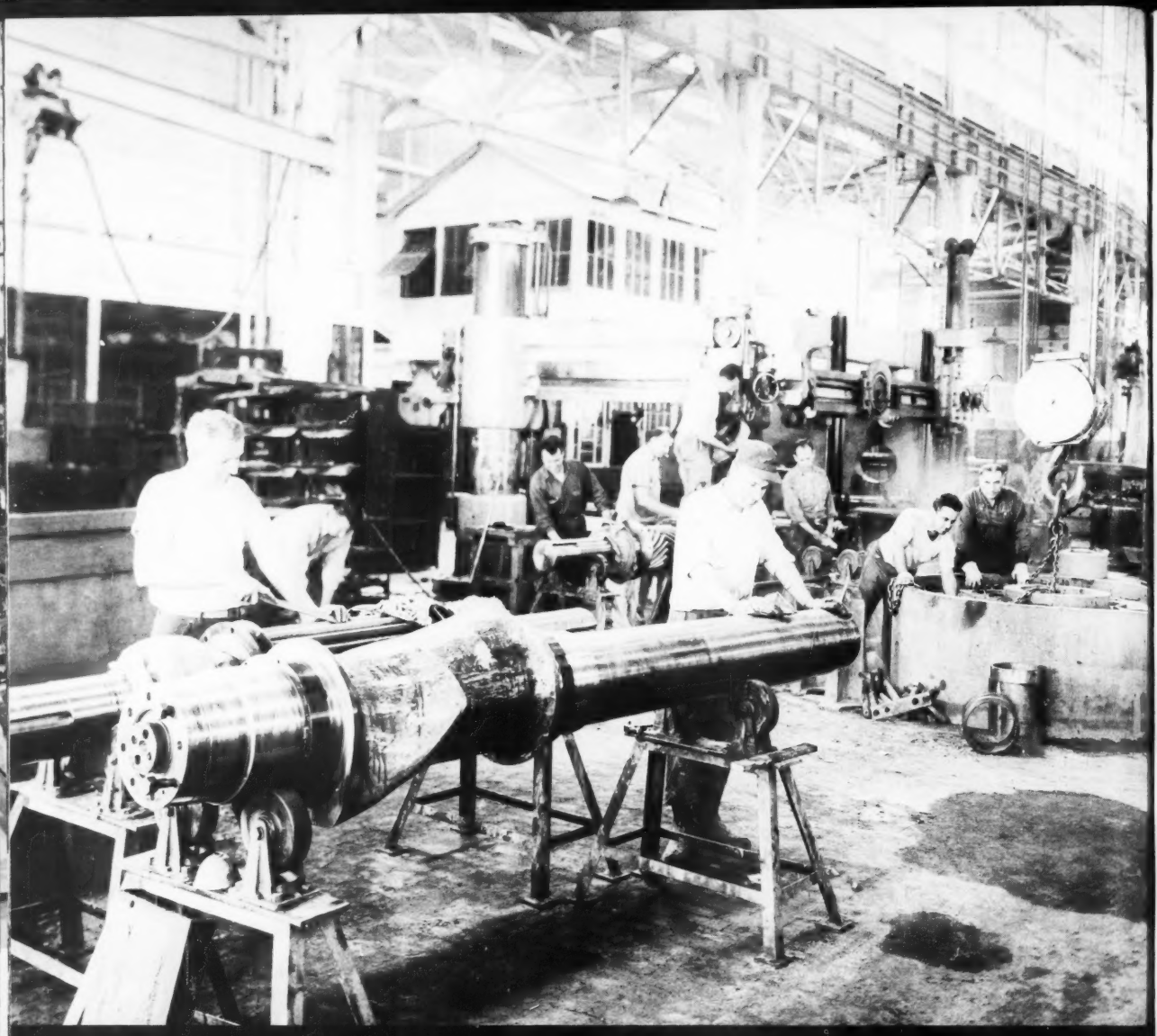
Second Right — Cleaning up the main driveway into the Derby plant.

Third Right — Bulldozing mud and debris out of front yard at Derby.

Bottom Right — With power partially restored at Derby, the welding department commenced operations with rented equipment ten days after flood day.

Below — Pattern storage buildings at Derby surrounded by flood waters. A number of wood patterns, as well as other floatable material, were washed away beyond recovery.





This shop, which was under 10½ feet of water ten days ago, is now busy cleaning up parts to expedite delivery of machines on order.

FARREL-BIRMINGHAM COMPANY, INC.

ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.

Bulletin No. 60

Printed in U.S.A. 559-1

FARREL-BIRMINGHAM COMPANY

INCORPORATED

PLANTS: ANSONIA AND DERBY, CONN., BUFFALO, N. Y.
GENERAL OFFICES: ANSONIA, CONN.

CONSOLIDATED MACHINE TOOL COMPANY DIVISION
ROCHESTER, N. Y.

ANSONIA, CONN. October 20, 1955

MORE HIGH WATER:

But this time we were forewarned and better prepared to cope with the smaller flood ensuing from the torrential rains that struck the Northeast on the week end beginning Friday, October 14th.

We do not want to minimize the proportions of this second disaster that brought destruction and grief to so many, but to the company itself, the damage was in no way comparable to what we experienced in the August flood. Flood water in Ansonia shops was measured in inches rather than in feet. Moreover, because the river had scoured its bed two months ago, there was less pollution and very little silt.

The entire loss due to this second flood is probably not one-tenth of what was sustained in the August flood. We are already back in production, and, therefore, our delivery schedules will not be delayed more than a few days.

Just because these two very severe storms struck the Northeast a few weeks apart, Farrel-Birmingham sees no reason to expect that our Connecticut plants will continue to suffer such flood damage in the future. My great-grandfather surveyed and planned the city of Ansonia before he and my grandfather built the first Farrel plant in 1848, and in these 107 years nothing as serious as the two recent floods ever occurred before. This also holds true in Derby where the Farrel-Birmingham plant was first established in 1836. Nevertheless, we are taking a great number of immediate precautions against any possible flood recurrence and are making some long-range plans for greater protection. Also, we are joining with other industries in our neighborhood in seeking quick action from Government agencies on projects to make the Naugatuck Valley safe from future flood disasters, not only for the sake of our factories, but for the safety and economic welfare of all the people in this densely populated industrial area.

Again the company wishes to pay tribute to a large number of employees who worked hard and late as the water was rising. Many worked into the early morning hours of high-water day, Sunday, the 16th, after having already worked a full shift. Also, the entire supervisory force was on hand until the plant was closed. I was with these men and know the great value of their effort, which spared a great deal of equipment and production from damage.

FARREL-BIRMINGHAM COMPANY, INC.

Franklin Farrel, 3d
President

News from Abroad

Germany

Cold Rubbers Analyzed

At the meeting of the Deutsche Kautschuk Gesellschaft, Munich, October 21-23, 1954, P. Orth, of Chemische Werke Huls, presented a lengthy paper on cold rubber in which he discussed the early history of cold rubber, American developments, and finally recent research work at Huls in the course of which Huls formulations including PFS (paraffinic acid—Na) plus Nekal, as emulsifier, and Diproxide, as regulator, were compared with formulations including Dresinate 214 (the potassium salt of dehydroabietic acid) and Diproxide.

Orth states that hardly any big differences were observed between the two formulations in the course of polymerization to 60% conversion. It was found, however, that:

(a) The tendency to form deposits on the walls of the reacting vessel is practically nil when Dresinate is used, and only slightly indicated for the PFS-Nekal composition. But if conversion is carried on to 70-72%, the latter showed up to 5% precipitation; such was not the case with Dresinate.

(b) Maintenance of the required raw Defo value of 700-800, in the case of the PFS-Nekal compound, largely depends on the surface tension of the latex; if this exceeds 42 dyn/cm., then the regulating action of Diproxide is incomplete, and the raw Defo may be as high as 4,000. Increased surface tension during polymerization is caused by the adsorption of the emulsifier on the polymerizate, which can be prevented by very careful dosing of the inorganic salts.

The Dresinate formula, on the other hand, is independent of the regulation of the surface tensions, which may rise from 32 dyn/cm. in the early polymerization stages up to 60 dyn/cm. at 60% conversion, without endangering the regulating function of the Diproxide.

Another difference is that Dresinate may vary between 3.5 to 4.7% on the hydrocarbon, without the need of change in the other components of the formula; hence the ratio emulsifier to inorganic salts need not be so strictly maintained as for the PFS-Nekal formula.

To judge the polymerizates and their vulcanizates, tests were conducted on the following tread mix:

	Grams
Polymerizate	100.0
Plasticizer R. A.	5.0
Stearic acid	1.0
ZnO RS	5.0
Sulfur	1.5
Carbon Black CK 4	40.0
Vulkacit A. Z.	1.0

The best values were obtained from mixes cured at 134° C. for 90 minutes. Outside of better structural strength (21 against 15), the physical level of the mix made with the Dresinate Redox compound was not distinguishable from that of the PFS-Nekal Redox compound. These tests were limited to the "sugar" formulae; sugar-free and "amino activated" polymerizations have yet to be worked on.

Comparisons were also made between tread compounds of the Huls cold rubber and Krylene (from Sarnia, Ont., Canada) and showed that Krylene compounds with CK 4 and with 40 parts of Philblack O were slightly superior to corresponding Huls compounds; but both rubbers gave similar results with 50 parts of Philblack O. It is noted that the Krylene, like the Dresinate compounds, showed superior structural strength to the Huls cold rubber which, it is suggested, may be due to the dehydroabietic acid content in the first two.

Further tests concerned the effect of different activators and regulators on the rate of polymerization of Redox compositions. In the case of both the Dresinate and PFS-Nekal formulations, polymerization was most rapid with p-methyl-isopropyl-benzol hydroperoxide as activator and t-dodecylmercaptan as regulator.

In the Nekal formulations, however, Defo regulation was defective, and Defo values of 2,500 were obtained instead of the required 800; satisfactory achievement of the latter value was only obtainable with Diproxide as the regulator. For perfect results with Diproxide, surface tension must not exceed 42 dyn/cm.; further tests will have to show the limits with t-dodecylmercaptan.

Before Huls had obtained the above-mentioned activator, it was attempted to accelerate polymerization by using increasing amounts of cumol hydroperoxide; but this only retarded the action; surprisingly enough, the K and Defo values of the Nekal formulae, unlike those of the Dresinate formulae, were not affected. It is suggested that the slowing down of polymerization in the presence of increasing concentrations of this activator might be avoided by increasing the doses of iron and glucose, on the theory that by underdosing of iron and glucose, the radicals that become free, when the activator decomposes, act not only as polymerization starters, but also have a chain-breaking function. A further explanation might be that the solvent of the activator—isopropyl benzoyl—retards the course of polymerization, and, when a certain threshold value is exceeded, this hydrocarbon acts as a polymerization poison.

Finally, cold rubbers with various Defo values were compared with hot polymerized Buna S3 (which has a high initial Defo, subsequently reduced by thermal degradation) and Buna S4 (similar to GR-S), when the advantage of cold rubber regulated to the required Defo from the start was clearly shown both in processing and allover mechanical properties, especially abrasion resistance.

The improved processability and properties of cold polymerized butadiene-styrene materials, it is suggested, offer the prospect of producing 70% conversion products with relatively favorable mechanical properties. Since the capacity of existing installations would thus be raised, and costs for recovery of monomer reduced, the process would be more economical than conversion to 60%. However, since tensile and particularly abrasion values of the 70% material are markedly poorer than those of the 60% product, the latter would have to be retained for tread compounds.

Durra-Korropren

Among the new products at recent shows may be mentioned Durra-Korropren, a self-vulcanizing anti-corrosion compound based on neoprene, put out by Franz Clouth, A.G., Cologne. The material, exhibited at Achema XI, in May, 1955, can be applied *in situ* on concrete, wood, steel, and other metal surfaces, to give an elastic, rubber-like coat that protects against acids, alkalis, salts, and various chemicals. It also resists abrasion, light, ozone, oil; is age-resistant, flameproof, and can be used up to temperature of 120° C. When granular substances are added, skid- and abrasion-resistant floor-coverings can be made that are, at the same time, protected against corrosion and chemicals.

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France

Relaxation Concept Unity Urged

At a meeting of the French Rheological Study Group in Paris, in May, 1954, P. Thirion presented a short paper: "Retarded Elasticity and Relaxation of Rubber,"[1] a study of the essentials of the viscoelastic behavior of raw and vulcanized rubber. The interpretation of creep curves is difficult because of the structural changes the samples undergo during the test. On the other hand the relaxation curves for vulcanized natural rubbers clearly indicate two extreme temperature zones where relaxation is important; in the area of average temperature at which rubber is used, relaxation is negligible. In the case of raw rubber, relaxation is significant and rapid even at average temperatures. In his conclusion, Thirion points to the need of unity in concepts, techniques, and vocabulary used in the field of rubber rheology already explored—as relaxation, creep, flow at constant rate—if further progress is to be made in this science.

[1] *Rev. gén. caoutchouc*, 31, 12, 982 (1954).

Rubber Industry Up in '54

The recovery of the French tire industry in 1954 from the setback experienced in 1953 is amply reflected in the official statistics of rubber imports and consumption for the year. Total arrivals of natural and synthetic rubber, which had dropped from 125,639 metric tons in 1952 to 123,534 tons in 1953, were up to 136,073 tons in 1954, with synthetic rubber representing roughly 10% of the total in the latter year. Consumption, which had been 145,286 metric tons in 1952 and 143,070 tons in 1953, advanced to 158,810 tons in 1954; the rise for the most part was due to the larger quantities taken by the tire industry—90,117 tons, against 77,929 tons in 1953 and 86,572 tons in 1952.

The amount of rubber going into general rubber goods increased again, from 65,102 tons in 1953 to 68,692 tons in 1954; the 1952 figure had been 58,714 tons. An examination of the details of consumption shows that the demand for rubber for footwear and rubber heels and soles fell off in 1954, but rose for all other goods, especially mechanical goods and sponge rubber.

French exports of tires also improved markedly, from a total of 31,362 tons in 1953 to 40,164 tons in 1954, with about 60% of the whole going to French overseas territories, mainly to Algeria, French West Africa, Indo-China, and Morocco. More than half of all the tires exported to these and other overseas French countries consisted of heavy-duty tires, which must be adapted to cope with the frequently difficult roadways.

•

Malaya

Clonal Seed Characteristics

In reply to a note from the Oriental Estates Agency Group, requesting his views on the contention that the second generation from clonal seed is no better than unselected material, the editor of the *Planters' Bulletin* of the Rubber Research Institute of Malaya (September, 1955) stated that for practical purposes this is true. But he added that the effects of selection remain to a slight degree even in the second generation. Clonal seed is obtained from pollination in a seed garden; the crossed progeny are intermediate between the parent clones and show a fair amount of variability. But their latent variability is much greater and includes recessive characters which do not appear until the second generation.

Labor's Demands

Following soon after the new agreements between estates and labor on wage rates, reported in these columns last month,[1] have come new demands, this time relating to paid vacations. At present plantation workers are liable for work seven days a week and under an old arrangement are entitled to three paid holidays a year, on festival days.

The National Union of Plantation Workers now wants the employers to give each worker three weeks' paid vacation annually; in addition the Union asks for a six-day week, and overtime if the worker is required to work on his weekly free day; finally it asks for automatic deduction of union subscription from the workers' wages. Apparently the question of holidays has roused strong feelings here, and many Union members advocated a go-slow policy by plantation workers if the holiday demands were not met.

The estates have known that the question of paid holidays would soon come up and the above demands are not a surprise. However, if after the recent wage agreement they have been telling themselves that there would be no further difficulties with the Union over pay for some time at least, they are by now undeceived. For it has been revealed that employers will soon be faced with further claims for improvement in the wages of Malaya's 320,000 rubber estate workers.

At the South-East Asian Plantation Workers' Conference, which met in Malaya at the end of September, the president of the National Union of Plantation Workers, P. P. Narayanan, who had been elected chairman of the conference, made a statement to the above effect following a speech by the delegate from the Philippines in which the latter had said that the minimum wage of the Malayan tapper was almost $2.00 under that of his opposite in the Philippines. Labor conditions, it may be added, were strongly criticized at the conference, especially by delegates from Malaya, Ceylon, the Philippines, and India.

A Malayan delegate, representing the National Estates Staff Union, stressed that information of production costs was essential if a fair wage structure was to be drawn up. Employers had refused to cooperate in an investigation recommended by the Whitton Board, and the unions were therefore still ignorant of costs, yet, he added, "the government has approved a $280,000,000 replanting scheme."

A few days before this conference, Mr. Narayanan, speaking at a trade union function in Penang, had assured the Federation Government, as represented by the Minister Tengku Abdul Rahman, the guest of honor, that the Trade Union movement in Malaya would not embarrass the popular government with labor troubles. But he still brought up the subject of a national minimum wage for Malaya, and he did not fail to add the warning that the days of cheap, sweated labor in Malaya were over, and that the sooner foreign investors realized this, the better for them.

Forward Contract Registration

On September 24 more details were published of the government scheme for registering forward contracts for rubber,[1] effective October 1. The scheme permits the registration of existing uncompleted contracts entered into before October 1 even if only one month's delivery or shipments remains to be made. Such contracts are to be screened by an advisory committee.

The only contracts eligible for registration are Singapore Chamber of Commerce Rubber Association f.o.b. and Rubber Trade Associations of London and New York, c.i.f., and c. and f. contracts. These contracts must provide for the movement of rubber out of the customs area and the delivery or shipment of not less than three, but not more than 12, equal monthly consignments of rubber, of which the first is not due for delivery before the first day of the second month after the date of registration.

Rubber Thefts

Rubber thefts have almost doubled since the boom began, and estate managers and police both are fully occupied in attempting to handle effectively what has become a serious situation for many estates. One of the biggest agency houses in Malaya has succeeded in reducing the amount of thieving on several of the estates under its management, and even ending it on some, by having armed guards patrol the estates. In the Klang district is Selangor, where several big thefts occurred, the police have been trying to get the cooperation of dealers in the hope of being able to trace those who are involved in the rubber stealing.

Speculating in "Paper" Rubber

With London and New York rubber closing prices as barometers, a growing number of Singapore business men (chiefly Chinese rubber men, although merchants of other races are also active) are speculating in "paper" rubber deals with unregistered brokers, the *Straits Times Commercial Reporter* learns. Such transactions have assumed enormous proportions since the beginning of the Korean War boom, and the number of unregistered brokerage firms has steadily increased until now about 50 are known to be operating in the Colony.

It seems that quotations by brokers are based on the fluctuating prices of rubber on the Singapore rubber market, and gains and losses are calculated on the marginal differences between the quotations at the time of the deal and the closing prices of the overseas markets. It seems that the minimum deal is for 100 piculs (picul is 133⅓ pounds, and for every 10 points in favor of his "position" a speculator makes $10 (Straits) per 100 piculs of the deal. The maximum he can make per 100 piculs apparently is limited to $50. But one deal may involve anything from the minimum up to 25,000 piculs, and fortunes have been known to change hands. Business is normally done over the telephone, and purchases and sales are made on a "gentleman's agreement basis." All gains and losses are settled on the following day when agency cables announce the closing prices of the overseas markets.

[1] See RUBBER WORLD, Oct., 1955, p. 110.

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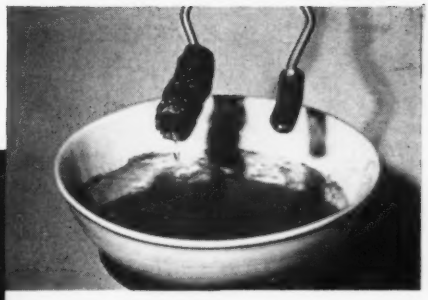
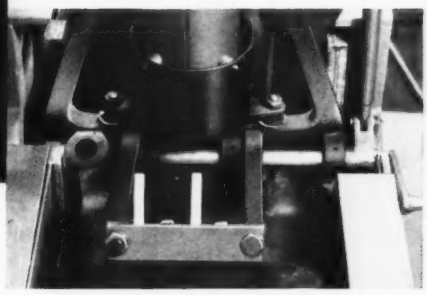


Stability at 500 F.



Elasticity at—100 F.

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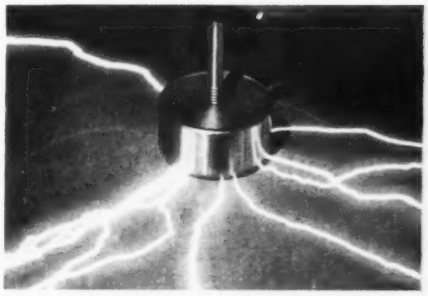

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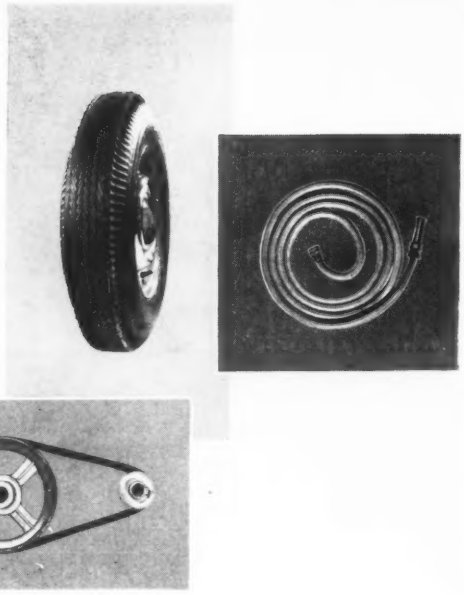

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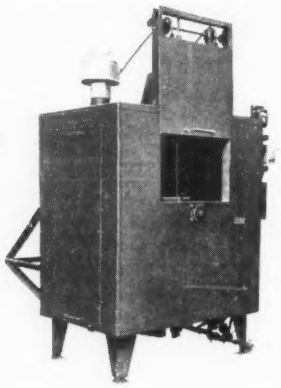


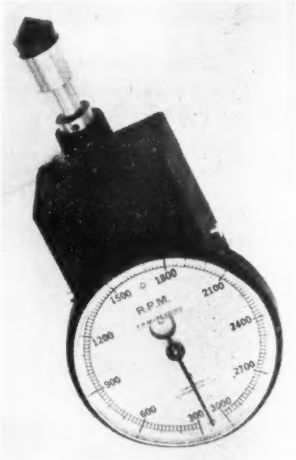
Mercury Industries' Roto-Molder

Two new models of its rotational molding unit designed specifically for use with vinyl plastisols have been made available by Mercury Industries, Inc., Hillsdale, N. J. Called Roto-Molder SD and SDE, the machines are said to offer such features as control of vinyl used for uniform finished product, elimination of contaminating materials, low operating cost, and simplicity of operation. The units occupy 68 by 74 inches of floor space.

Applications are for the manufacture of toys, novelties, play balls, advertising specialties, and industrial items.

Mechanical-Principle Hand Tachometer

A single-range, mechanical-principle hand tachometer that gives continuous indication of speed has been introduced by Jones Motrola Corp., Stamford, Conn. Models are available in seven speed ranges, from 50 to 10,000 rpm., registering either direction of rotation without adjustment. A stop-button permits retaining of dial reading. The device is unaffected by temperature, moisture, electrical currents, or magnetic conditions because of the centrifugal-mechanical principle under which it operates.



Jones Motrola Corp.'s hand tachometer

Fully Automatic Industrial Autoclave

What is said to be the first completely automatic industrial autoclave has been placed on the market by Philips & Davies, Inc., Kenton, O. A control cabinet, through which one workman can operate as much as a bank of eight autoclaves, provides control of such factors as time, heat, cycling, air, water, and steam, as well as the machine's opening and closing mechanism, according to the company, with a written record being registered for each complete cycle. Other features include a long-life silicone rubber gasket, a specially designed locking mechanism, and manual controls in case of power failure.

Specifications of the autoclave include the following: working air pressure, 100 psi.; weight, 10,240 pounds; control cabinet weight, 2,100 pounds; power required, 440 or 220 volts, 3-phase.

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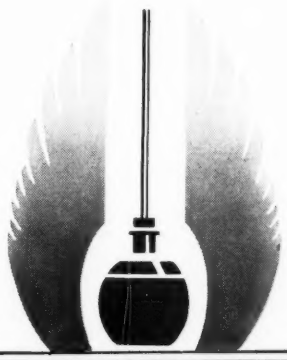

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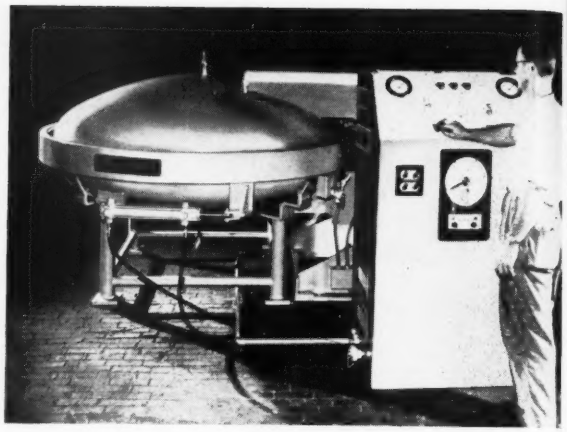


P & D autoclave and control cabinet

60-cycle; inside diameter, 84 inches; inside depth, 36 inches; and floor area needed for autoclave and control cabinet, 9 5/12 by 11 3/4 feet. Electrical equipment for this autoclave is of explosion-proof construction.

The autoclave is recommended for vulcanizing and curing rubber goods and for laminating and processing plastics products, as well as for other processes requiring heat under pressure.

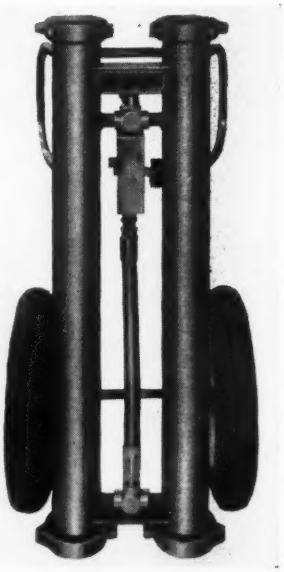
Low-Cost Energizing Alternators

Low-cost alternators capable of supplying economical power for energizing multiple arrays of above-audible sound generating transducers needed to irradiate materials and products being processed in quantity have been introduced by Acoustica Associates, Inc., Glenwood Landing, L. I., N. Y. Ultrasonics have shown experimental promise for the rubber, plastics, textile, food, drug, petroleum, and paint industries by being capable of causing such physical phenomena as chemical activity acceleration, so-called cold boiling, agitation, agglomeration, emulsification of resins and oils, and pigment dispersion.

The Acoustica alternators are available in a range of 2-150 kilowatts and in systems designed for specific processing. Operation of the equipment requires no special training, the company says.

Portable Filter Buggy

A filter buggy that provides on-the-spot filtration for all hydraulic systems and machines has been placed on the market by Schroeder Bros., Pittsburgh, Pa. Mounted on either pneumatic or solid rubber-tired wheels for quick relocation, the unit uses hydraulic power furnished by the machine to which it is attached, although pump and motor can be supplied with it. The filter is composed of cellulose impregnated with phenolic resin and has a filtering area of 13,944 square inches. Initial particle selection is 10 microns, permitting oil additives to pass through. Relief valves with a maximum pressure differential of 40 psi. protect the filter elements.



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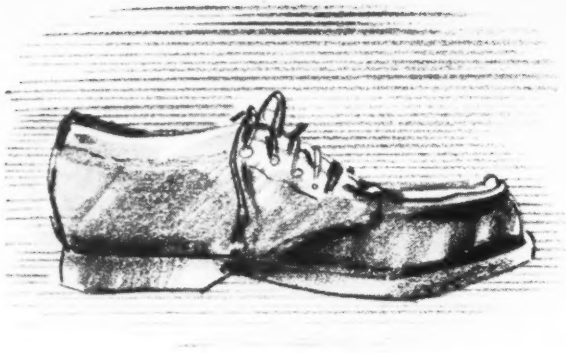

Diary of an old shoe

"Walked, walked, walked— on pavement and dirt— month after month —mile after mile, rain or shine..."

But this shoe could take it! It is one of millions of shoes that have the modern type of rubber sole reinforced by the incorporation of high styrene resins and plasticized with low cost **PANAREZ** hydrocarbon resins.

PANAREZ resins are tack producing agents and rubber softeners which make definite improvements in "flex crack", abrasion and tear resistance, tensile strength, and aging properties. At the same time, **PANAREZ** resins permit the use of larger than normal quantities of filler without sacrificing quality. This has resulted in important reductions in raw material costs.

PANAREZ resins, derived from petroleum, act excellently as polymeric plasticizers. They provide excellent color and color stability. They have low specific gravity. They are particularly useful in GRS rubbers where improvements in processability and stock physicals are desired—at a simultaneously reduced cost.

Whether you compound or use rubber for shoe soles, wire covering, floor tiles, tires, hose, insulators or some other products, we welcome the opportunity to work confidentially with you on your particular problem. Readily available in various color grades and unlimited quantities, **PANAREZ** resins offer the compounder a completely reliable, low cost raw material.

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NEW MATERIALS

Synthetic Latex Stabilizer, Viscosity Controller

A water-soluble polymeric organic chemical that is said to have proved valuable in the production of synthetic latex, serving both as stabilizer and as a means of controlling viscosity, has been developed by General Latex & Chemical Corp., Cambridge, Mass. Called AK-534, the material, whose formula has not been disclosed, is said to resemble a soap in its precipitation from aqueous solutions by acids, forming calcium or magnesium salts, but it differs from soaps in such ways as lowering the surface tension of aqueous solutions. Tests proving its value as stabilizer and viscosity controller in synthetic latex production were conducted by means of bottle polymerization, the company says.

A molecular weight of 35,000 is reported for AK-534. Additional characteristics of the material include its color stability and its ability to disperse many materials. AK-534 is currently being supplied in an aqueous solution of 10% active solid content.

Test data sheets may be obtained from the company on request.

Butadiene-Acrylonitrile Latex—Nitrex 2612

A butadiene-acrylonitrile latex, suggested for such uses as paper and fiber saturation to increase strength and resistance to oil, leather finishing, and as a plasticizer for resin latices and polyvinyl chloride, has been made available by Naugatuck Chemical Division of United States Rubber Co., Naugatuck, Conn.

Called Nitrex 2612, the material is said to be a colloidal dispersion for which an emulsifying system has been developed to provide stability in storage and compounding, and minimum discoloration of the film on aging. The latex is supplied containing an antioxidant of the non-discoloring, non-staining type.

Some reported typical properties include:

Total solids concentration	38-40%
Viscosity (Brookfield) #1 spindle @ 20 rpm	35 cp.
pH value	9.5-11.0
Mechanical stability	good
Chemical stability	coagulated by acids and salts
Color of dried film	translucent

Technical data sheets describing the latex may be obtained from the company.

Silastics 430 Gum, 432 Base

Two new intermediate silicone rubber products, Silastic 430 Gum, a polymer, and Silastic 432 Base, a reinforced gum or masterbatch, have been introduced by Dow Corning Corp., Midland, Mich. Silastic 430 Gum is said to be an easy-to-compound silicone gum with inherent low set and low shrink characteristics, which, when properly cured, provides tough, high-strength silicone rubber parts that are serviceable from –70 to 500° F.

Silastic 432 Base is said to consist of 80% silicone polymer and 20% Dow Corning Silica filler and is designed to facilitate the compounding of silicone rubbers serviceable from –70 to 500° F. Believed to be the first silicone rubber masterbatch ever offered, the material is reported to be easily and rapidly blended with additional fillers or extenders. Inherent low shrink and low

(*Continued on page 298*)

The Important Qualities You Want In MAGNESIUM OXIDE For Rubber or Neoprene Compounding are AVAILABLE in DCI LIGHT CALCINED MAGNESIA

(Powdered or Granular)

REQUIREMENTS

★ MgO with low Fe_2O_3, Al_2O_3 and CaO content
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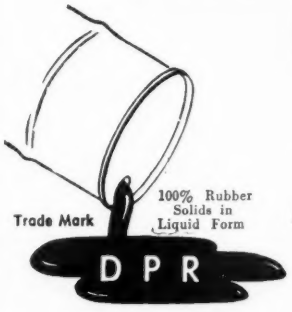

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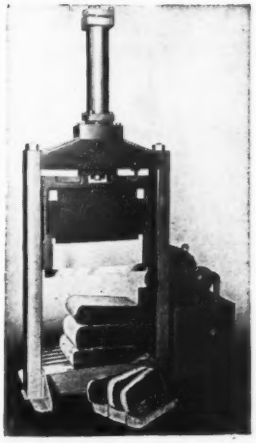

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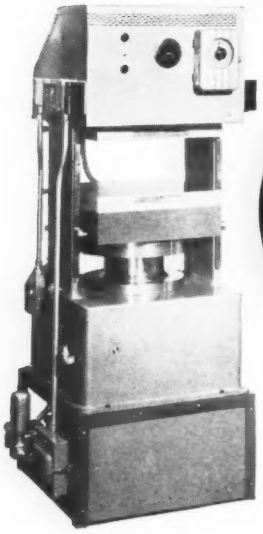

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NEW PRODUCTS

U. S. Laytex Royal Master Portable Cord

Electrical Cord for Portable Tools

A new electrical cord for such heavy-duty portable electrical tools as grinders, drills, power-saws, and buffers has been placed on the market by United States Rubber Co., New York, N. Y. Dubbed U. S. Laytex Royal Master Portable Cord, it is said to incorporate features new in cord construction, and a service life three times longer than present highest-quality cords is claimed for it. Other rated improvements over similar cords include 488% greater resistance to flexing, 118% more resistance to tearing, 197% greater impact strength, and 33% more heat resistance, according to the company.

Firestone Super Champion Tubeless

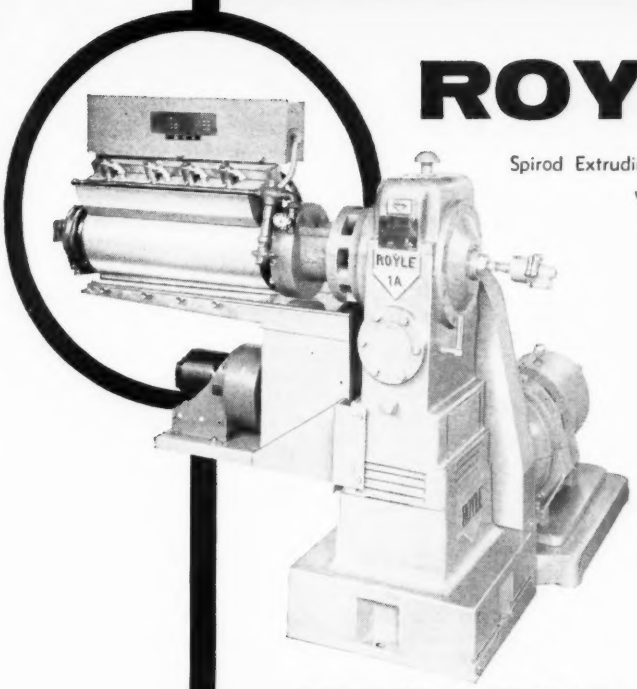
A new second-line rayon cord tubeless tire with inner safety liner has been placed on the market by The Firestone Tire & Rubber Co., Akron, O. Designated Super Champion, the tire's safety liner is made of synthetic rubber and is said to provide greater puncture and blowout protection than an inner tube. The tire's tread is the same as that of the company's Super Champion tire and tube. A choice of black or white sidewall is available.

Goodrich Water Suction Hose

A water suction hose that springs back to original shape if run over by trucks or other heavy equipment has been placed on the market by The B. F. Goodrich Co., Industrial Products Division, Akron, O. Called Morecon, the hose is constructed of a continuous coil of hemp rope embedded in thick rubber and is surfaced by medium weight fabric plies. The hemp rope causes the hose's springiness, the company says. Recommended for normal suction in the handling of gritty and mildly corrosive fluids, the new hose is available in 1-, 1¼-, 1½-, 2-, 2½-, and 3-inch sizes.

Cleated Conveyor Belt

A cleated rubber conveyor belt, designed to carry loads up inclines of 30% or more where a non-ridged conveyor belt would permit slippage, has been introduced by The Goodyear Tire & Rubber Co., Akron, O. The belt is available in a variety of plies, cover thicknesses, widths, and rubber compounds, with cleats available in heights of ⅜-, ½-, one inch and 1½ inches.



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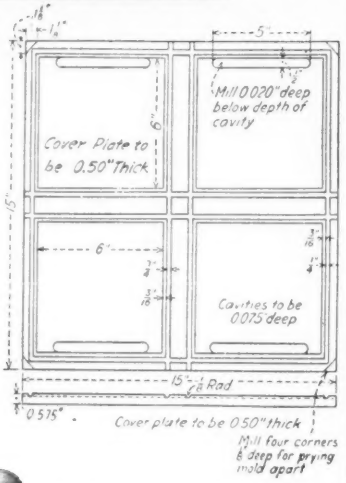
Mill 0.020" deep below depth of cavity
Cover Plate to be 0.50" Thick
Cavities to be 0.075 deep
Cover plate to be 0.50" thick
Mill four corners 6 deep for prying mold apart

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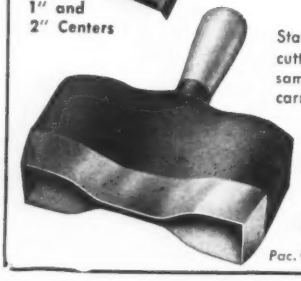

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Anaconda Densheath 900 Insulated Wire

A dual-purpose wire which can be used both as a building wire and a machine tool or appliance wire, thus cutting down on inventory, has been developed by Anaconda Wire & Cable Co., New York, N. Y. Called Densheath 900, the wire consists of a copper conductor insulated with an oil-and-moisture resistant polyvinyl chloride 90° C. compound and covered with a slipper compound to insure ease of pulling in conduits. Rated at 600 volts, the wire is available in sizes 14 AWG to 2,000 mcm. when used as TW; and in sizes 14 to 4/0 AWG when used as appliance wire.

Self-Inking Roller for Metal Address Plates

A new self-inking synthetic rubber roller for metal address plates has been developed by Dayton Rubber Co., Dayton, O., to give sharper impressions and longer life. These rollers are said to cost less than the old ones that used a powdered graphite for inking.

With this improved roller, by means of a special vacuum process, air is forced out of the roller, and ink is run deep into the pores. Fresh ink keeps working to the surface as the roller is used.

Department stores and auto service stations are main users of these new rollers, but they are being tested for eventual use on other business machines.

Since service station plates are often kept outdoors, a special ink was developed to flow freely in temperatures from 0 to 100°. The ink uses dyes instead of the usual pigments.

Aluminum-Asbestos Pipe Jacketing

Aluminized pipe jacketing made of aluminum foil laminated on to vapor-proofed asbestos cloth has been placed on the market by United States Rubber Co., New York, N. Y. Called Asbeston pipe insulation jacketing, the material is said to be resistant to fire, acid and water, never requires painting, is easily cleaned, does not absorb odors, and weighs half as much as conventional asbestos jacketing cloths. It is recommended for most industrial, commercial, and institutional exposed pipe applications.

Silastics

(*Continued from page 294*)

compression set characteristics eliminate the need of toxic additives. Applications include mechanical goods, gaskets and seals, extrusions, and wire coating.

Some typical properties of the new products are the following:

	Silastic 430 Gum	Silastic 432 Base
Color	colorless and translucent	
Plasticity (Williams) mils	47	80
Specific gravity @ 25° C.	0.98	1.1
Brittle point, ° F., when compounded (ASTM D746-54T)	—100	—100

Technical data sheets on the materials, References 1-206 and 1-205, may be obtained from the company on request.

Flexol Plasticizers 810x and 10-10x

Flexol plasticizers 810 (a higher alcohol phthalate) and 10-10 (didecyl phthalate), compounded with an antioxidant, have been made available by Carbide & Carbon Chemicals Co., division of Union Carbide & Carbon Corp., New York, N. Y. Called Flexol 810x and Flexol 10-10x, the materials are said to be improved in heat aging properties in vinyl compounds for high-temperature use through the addition of the antioxidant. Vinyl electrical insulation compounds are especially improved, the company says.

TECHNICAL BOOKS

BOOK REVIEWS

"International Rubber Directory." Second Edition. Publishers, Verlag fuer Internationale Wirtschaftsliteratur GmbH., P.O.B. 108, Zurich 47, Switzerland. Cloth, 6 by 9 inches, 576 pages. Price, $12.80.

This is the second edition of the Swiss trilingual (English, French, German) directory of the world's rubber goods manufacturers, and it mirrors the continuing expansion of the industry since the first edition was published in 1953. That volume had 150 pages less than the current compilation, and considering that this 1955 edition was based on data compiled during 1954, it seems certain that the third edition yet to be published, based as it will be on this boom year 1955, will be larger still. The United States, for example, had 45 pages of rubber manufacturers listed in the first edition, with 60 pages now devoted to it in the present volume. Other countries reflect a similar growth.

Again, in addition to the main listings of firms, the number of their employes, and the sort of goods they manufacture, there are sections devoted to associations and federations, schools and research laboratories, periodicals, a comprehensive buyers' guide, a complete alphabetical manufacturers index, and a trilingual technical vocabulary to aid the international sale and purchase of products.

"Handbook of Engineering Materials." Edited by Douglas F. Miner and John B. Seastone. John Wiley & Sons, Inc., New York, N. Y. Cloth, 5½ by 8½ inches, 1093 pages. Price, $17.50.

Designed for the engineer as a single source of useful information on the usual materials of manufacturing and construction, this handbook has as its scope, according to the editors, a point somewhere between a technical dictionary and a shelf of specialized textbooks. The information has been arranged by classes of related or similar materials to make a common meeting ground for engineers of whatever specialty.

The handbook is divided into four major sections: general information on materials, metals, non-metals, and construction materials. The section on plastics and rubbers, written by C. C. Winding, assistant director, school of chemical and metallurgical engineering, Cornell University, spans 183 pages and represents in itself a small but definitive volume on these materials.

The remainder of the text is the work of 50 other contributors, and, as in all good handbooks, a mass of easily thumbed tables and graphs is included. The volume also abounds in selected references and bibliography.

"Brand of the Tartan." Virginia Huck. Appleton-Century-Crofts, Inc., New York, N. Y. 260 pages. Price, $3.50.

Subtitled "The 3M Story," this is a thorough and lively account of the growth of Minnesota Mining & Mfg. Co. from its beginnings in 1902, when it was launched in northern Minnesota to exploit a deposit of corundum, to its current position as one of the nation's most thriving industrial enterprises.

NEW PUBLICATIONS

"The Proper Way to Cushion a Shoe." Airfoam Division, The Goodyear Tire & Rubber Co., Akron, O. 16 pages. This amusingly illustrated booklet presents a history of shoe cushioning; the reasons for Goodyear's development of special foam-rubber shoe cushioning products; and how Airfoot and Super Airfoot are used in shoes for men, women, and children.

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Publications of United States Department of Commerce, Office of Technical Services, Washington, D. C.:

"Development of High-Temperature Oil-Resistant Rubber." PB 111693. 134 pages. Price, $3.50. This is a report of research done at Battelle Memorial Institute for Wright Air Development Center, U. S. Air Force, toward the development of a rubber compound which would withstand long contact with ester-type lubricants at 350° F. and with hydraulic fluids up to 550° F. Details of each experiment conducted are included. Promising results were obtained with two acrylate polymers and with one experimental rubber which met minimum specifications for use in Turbo Oil-15 at 350° F.

"Synthetic Diene Elastomers Prepared at High Temperatures." PB 111641. 59 pages. Price, $1.50. This is a report of research done at Battelle Memorial Institute for the U. S. Army Quartermaster Corps concerning the effects of high-temperature emulsion polymerization on balance of oil resistance and low-temperature properties of butadiene elastomers. A variety of practical results was achieved, including the discovery that some emulsion-polymerization recipes previously considered impractical were controllable and reproducible.

"Vulcanization of Rubber with High-Intensity Gamma Radiation." PB 111675. 37 pages. Price, $1. Describing research done at Wright Air Development Center, materials laboratory, on the crosslinking of uncured vulcanizable elastomers by means of high-energy gamma rays and without chemical vulcanizing agents or high-curing temperatures, this report discusses the techniques of such vulcanization and the properties of the resultant elastomers. It was found that the rubbers were uniformly vulcanized and did not retain residual radioactivity. They exhibited vastly improved resistance to dry heat and oil aging than chemically vulcanized compounds.

"Research on Boron Polymers—Literature Survey." PB 111689. 58 pages. Price, $1.50. The purpose of this survey, done at Rutgers University for Wright Air Development Center, was to approach the isolation of hydrolytically stable polymeric materials of exceptional fuel and oil resistance, high thermal stability, and other properties important in Air Force applications, with particular attention to boron compounds. The most practical approach appeared to be through the use of boron compounds based on amide linkage. This literature survey was only the first step in a proposed program of actual research.

Publications of The B. F. Goodrich Co., Akron, O.:

"B. F. Goodrich Automation Conveyor Belts." 2 pages. Described here are four of the firm's conveyor belts: namely, Tan Koroseal Belt, Caripack, Highseal, and Economy.

"B. F. Goodrich Gasoline Pump and Tank Hose." 2 pages. This data sheet illustrates and describes an improved type of gasoline pump hose. Information about pump hose couplings and spring guards also is given.

"Compressed Asbestos Sheet Packing." 4 pages. Specifications and uses of 11 grades of sheet are listed in this folder. Grades cover high-grade sheets for severe conditions; synthetic bonded types, neoprene and Hycar, where oil and solvents are involved; and competitive qualities for general-purpose use and where price may be a factor.

"New Patapar Releasing Parchments." Paterson Parchment Paper Co., Bristol, Pa. This attractive envelope folder contains two one-page data sheets and a good-size sample each of Patapar 55-40T, "a tough flexible releasing type of Patapar vegetable parchment with heat stability"; and of Patapar 55-41T, "a superior releasing type of Patapar vegetable parchment with excellent heat stability." Each data sheet covers such points as properties, caliper, weight, and uses. Among such uses are as a backing sheet for rubber during curing and also for uncured rubber; release backing for rubber; flexible tray liner; interleavers for slab rubber; all-purpose protective backing; pressure-sensitive label backing; separator strip for rubber splicing tapes.

"The Prevention of Occupational Skin Diseases." Louis Schwartz. Association of American Soap & Glycerine Producers, Inc., New York, N. Y. 42 pages. The causes, cures, and prevention of occupational skin diseases, which constitute about two-thirds of all occupational diseases reported to state compensation boards, are discussed here by a former U. S. Public Health Service medical director.

"Emeryfacts, Specifications and Characteristics." Emery Industries, Inc., Cincinnati, O. 4 pages. Specifications of the company's fatty acids and derivatives are reported in this brochure.

"Naugatex High-Quality Synthetic Latex." Naugatuck Chemical, division of United States Rubber Co., Naugatuck, Conn. 8 pages. Specifications and applications of the company's hot and cold synthetic latices are presented in this booklet.

"Polypol S-70 in Semi-Hard Rubber Compounds." Technical Bulletin No. 203. West Virginia Pulp & Paper Co., polychemicals division, Charleston A, S. C. 2 pages. This data sheet gives the properties of semi-hard rubber compounds made with Polypol S-70 compared with those of the 1500-type GR-S copolymer.

"Softeners in Nitrile Rubber." Rubber Laboratory Release No. 15. Barrett Division, Allied Chemical & Dye Corp., New York, N. Y. 8 pages. This booklet deals with the application of Cumar Resin MH-2½, dibutyl phthalate, and diethylene glycol in a mineral-filled nitrile elastomer. This compound has been formulated to provide a Shore A durometer hardness of 90 and at the same time give advantageous properties for a number of varied applications.

"Stan-Tone MBS Colors." Bulletin #02-14-1-9-55. Harwick Standard Chemical Co., Akron, O. 3 pages. This is a revision of an earlier bulletin dealing with Stan-Tone MBS colors, some of which are recommended for rubber. Among the changes are the elimination of certain colors and the addition of new ones including MBS 110 Orange and MBS 405 Blue, which are of interest to the rubber industry. The Stan-Tone colors are manufactured by Sinclair & Valentine Co. and distributed by the Harwick organization.

"Heat Stable Phthalocyanine Blue." Bulletin No. 150. Claremont Pigment Dispersion Corp., Brooklyn, N. Y. 1 page. Properties of this blue pigment for vinyl compounding are discussed.

"The Interaction of Polymerizing Systems with Rubber and Its Homologues. Part III. Transfer and Retardation in the Polymerization of Vinyl Acetate." P. W. Allen, F. M. Merrett, and J. Scanlan. Publication No. 208. The British Rubber Producers' Research Association, Welwyn Garden City, Herts, England. 10 pages.

"How Temperatures Are Measured." Tempil Corp., New York, N. Y. 8 pages. The history of temperature indicating devices and some current techniques for such measurement are discussed in this booklet by a manufacturer of temperature indicating crayons, liquids, paints, and pellets.

"Journal of Polymer Science." Vol. XII, Issue No. 76. Interscience Publishers, Inc., New York, N. Y. 638 pages. Price, $15.00. This is a collection of the papers presented at the International Union of Pure & Applied Chemistry's symposium on macromolecules, held in Sweden, July, 1953.

"Admex Epoxy Plasticizers for Vinyl Resins." Bulletin No. 101-C. Archer-Daniels-Midland Co., Minneapolis, Minn. 26 pages. The physical properties, compatibility, and applications of the company's Admex 710, 711, and 744 epoxy plasticizers are reported in this publication.

"Green Book Buyers Directory." 1955-1956. Schnell Publishing Co., Inc., New York, N. Y. 1664 pages. The forty-third edition of an annual compilation of the American sources of supply for chemicals and related process materials, published as part of an annual subscription to the weekly periodical, *Oil, Paint and Drug Reporter*, the "Green Book" lists suppliers under specific chemicals, alphabetically arranged, and reports the addresses of these suppliers in a separate index. Firms offering technical and commercial services are also included.

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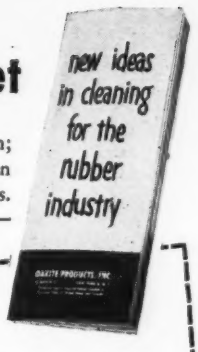

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MARKET REVIEWS

Natural Rubber

The bottom finally dropped out of the inflated natural rubber market during the period from September 16 to October 15, and prices slid quickly to about where they had been at the end of July. A dizzy differential of almost 7¢ a pound for spot R.S.S. #1 was achieved in the short time of 18 trading days; a near eight-year high of 50.13¢ was recorded for the grade on September 20; the figure declined steadily to 43.25¢ on October 14. Expectedly, trading on the New York Commodity Exchange was heavy, with 6,588 lots being exchanged during the period. The price peak was reached at the end of the previous period, on September 14 and 15, when spot R.S.S. #1 was quoted at 50.50¢, the highest price since free trading was resumed in 1947.

The collapse first got under way on September 26 in the general wave of stock market selling triggered by the sudden illness of President Eisenhower, but the onus for continued decline quickly shifted abroad in a series of fast-breaking developments. On September 27, Singapore rubber prices posted sharp drops on the heels of an announcement by the British Crown Colony Government of a plan, effective almost immediately, providing for registration of forward shipment rubber and the fixing of export duty in advance. Heavy selling by upcountry producers followed. On September 29 presidential elections in Indonesia caused world-wide concern as great Communist electoral gains became evident. The two succeeding weeks saw mass speculative liquidation take place in London and Singapore. Finally, nervous observers noted the dropping away of European demand for all grades. Together with all this was rising production of synthetic rubber in the United States and increased shipments of the commodity abroad.

Returning to statistical details for the period under consideration, on the New York Commodity Exchange, sales for the second half of September were 33,640 tons, bringing the monthly total to 63,740 tons. Sales during the first half of October reached 32.240 tons, 65,880 tons for the period. Near-December stocks began the period at 48¢ and fell to 41.25¢ by October 14. Far-December stocks moved from 41.50¢ to 34.40¢.

On the physical market, R.S.S. #1 began the period at 49¢, rose to its high of 50.13¢ on September 20, then dropped steadily with normal fluctuation to a low of 43.25¢ at period-end.

September monthly average spot prices for representative grades follow: R.S.S. #1, 48.94¢; R.S.S. #3, 48.31¢; #3 Amber Blankets, 38.79¢ and Flat Bark, 36.48¢. For the first half of October, R.S.S. #1 averaged 44.93¢ a pound.

NEW YORK SPOT MARKET
WEEK-END CLOSING PRICES

	Sept. 17	Sept. 24	Oct. 1	Oct. 8	Oct. 15
R.S.S.: #1	49.00	49.13	47.25	45.75	43.25
2	48.75	48.88	47.00	45.50	43.00
3	48.38	48.50	46.75	45.25	43.75
Latex Crepe					
#1 Thick	50.25	50.38	48.50	47.50	45.25
Thin	50.25	50.38	48.50	47.50	45.25
#3 Amber Blankets	38.50	37.88	38.25	37.00	36.00
Thin Brown Crepe	38.13	37.50	37.75	36.50	35.50
Flat Bark	36.25	36.00	33.88	32.38	31.00

COMMODITY EXCHANGE
WEEK-END CLOSING PRICES

Futures	Sept. 17	Sept. 24	Oct. 1	Oct. 8	Oct. 15
1955					
Dec.	48.00	48.35	46.00	43.85	41.25
1956					
Mar.	45.80	46.10	43.85	41.70	38.95
May	44.80	44.95	42.35	40.30	37.90
July	43.80	43.75	41.25	39.15	36.60
Sept.	42.75	42.60	39.90	38.10	35.50
Dec.	41.50	41.40	38.70	37.00	34.40
Total weekly sales, tons	16,900	12,570	15,320	18,300	13,940

Synthetic Rubber

With no change in the tight demand/supply situation for GR-S type synthetic rubber in this country and with growing foreign demand, one producer has announced an increase in export prices. American Synthetic Rubber Corp. has raised the price of ASRC 1500 and 1502 to 26¢ a pound for quantities of 70,000 pounds or more, and to 26½¢ a pound for less than 70,000-pound quantities, prices F.A.S. Atlantic and Gulf ports.

No changes in prices for domestic consumers have been announced, but with more orders than can be filled with reasonable promptness, producers are considering reducing the number of types in order to obtain more total production. Consumers will then have to choose between improved delivery schedules and obtaining the exact type they require. Since some types vary only in that they contain one grade of non-staining stabilizer instead of another, some adjustments by the consumer should be possible with a minimum of dislocation of fabricating plant operations.

The International Rubber Study Group meeting which was concluded in Liberia on October 21 emphasized the tight world rubber situation when it reported only a 35,000-ton excess of supply over demand for 1955. Steps to increase both natural and synthetic rubber production immediately were inferred, and additional synthetic rubber expansion plans have recently been announced in the United States.

W. S. Richardson, president, The B. F. Goodrich Co., in a recent address warned that the world will require 500,000 more tons of synthetic annually in five years. Present and future expansions of synthetic rubber production capacity will require expansion of raw material production capacity, and new butadiene plants or additions to existing plants have been announced by Firestone, Phillips Petroleum, and Petro-Tex Chemical Corp. A plant to produce Ameripol SN, the synthetic polyisoprene said to duplicate natural rubber for truck and bus tires, will be built by B. F. Goodrich.

Downward trend in natural rubber prices may take some of the pressure off synthetic in the near future.

Latex

Activity in *Hevea* and synthetic latices during the period from September 16 to October 15 picked up considerably from the listlessness of the preceding period. Trading in the natural latex, especially, was comparatively brisk as prices, tied to dry rubber, tumbled to a level at which consumers were willing to replenish their stocks. Forward orders, as well as spot demands, were placed. Buyers were not certain how long the price decline would continue, but it was apparent they were reluctant to wait any longer.

Stocks of natural latex were consequently believed to have been strengthened during the period, though they were far from secure. GR-S latex stocks again were seen to be short, with no resolution of the situation in view within the next few months.

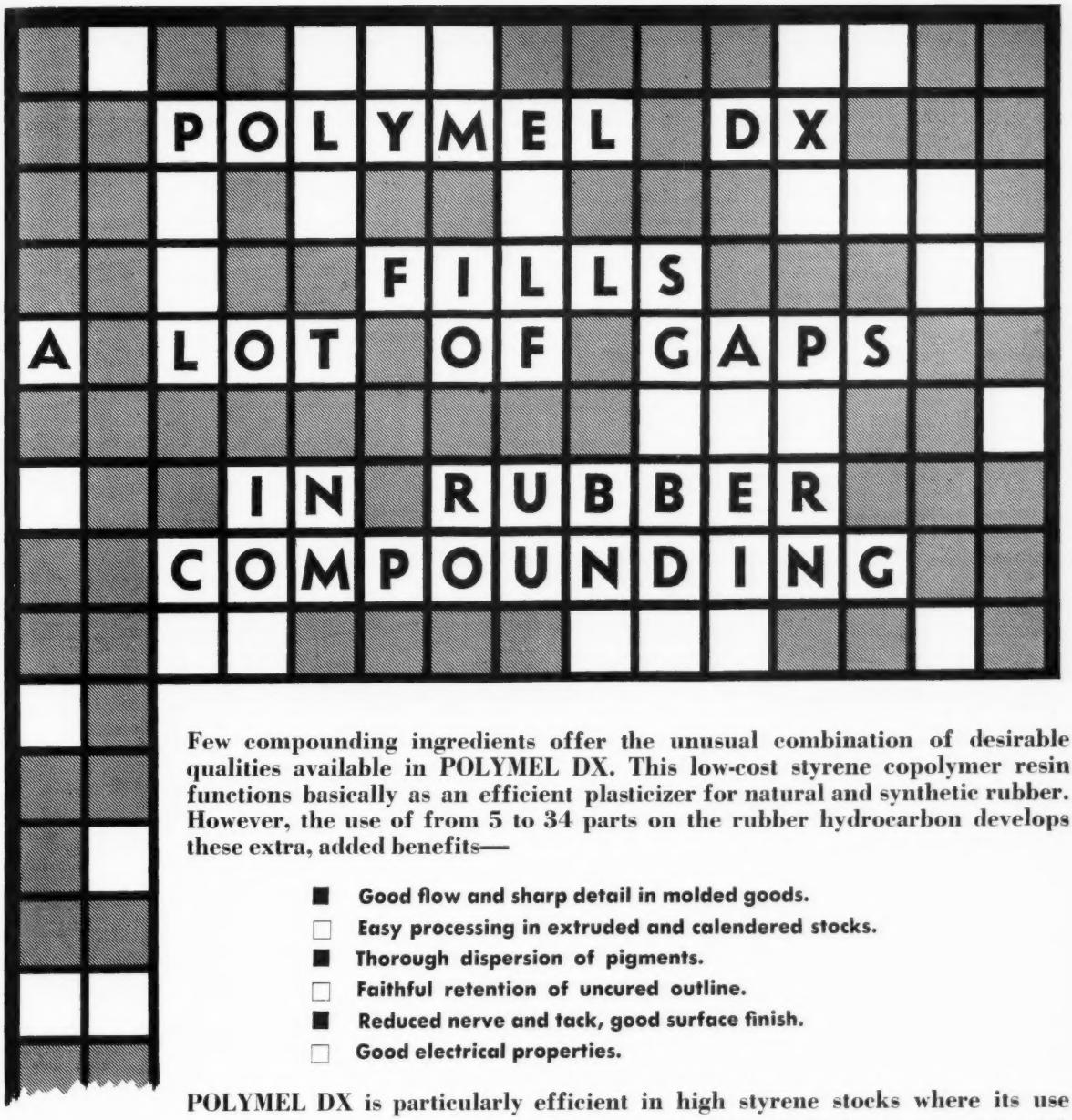
Prices for ASTM Centrifuged Concentrated latex fell during the period, ranging, in tank-car quantities, f.o.b. rail tank cars, from 50 to 61½¢ per pound solids. Synthetic latices remained the same as last period: GR-S, 26-32.3¢; neoprene, 37-47¢; and N-type, 46-54¢.

Final July and preliminary August domestic statistics for all latices follow:

(All Figures in Long Tons, Dry Weight)

Type of Latex	Production	Imports	Consumption	Month-End Stocks
Natural				
July	0	8,702	5,469	11,934
Aug.	0	. . .	6,878	11,970
GR-S				
July	4,723	30	3,830	6,950
Aug.	4,379	77	4,552	6,125
Neoprene				
July	641	0	535	850
Aug.	881	0	813	810
Nitrile				
June	993	0	626	1,397
July	917	0	860	1,269

NOTE: The price range of *Hevea* latex during the August 16-September 15 period was 51½ to 60½¢ per pound solids, in bulk. The figure of 42 2/3¢ quoted in last month's issue was erroneous.



Few compounding ingredients offer the unusual combination of desirable qualities available in POLYMEL DX. This low-cost styrene copolymer resin functions basically as an efficient plasticizer for natural and synthetic rubber. However, the use of from 5 to 34 parts on the rubber hydrocarbon develops these extra, added benefits—

- ■ **Good flow and sharp detail in molded goods.**
- □ **Easy processing in extruded and calendered stocks.**
- ■ **Thorough dispersion of pigments.**
- □ **Faithful retention of uncured outline.**
- ■ **Reduced nerve and tack, good surface finish.**
- □ **Good electrical properties.**

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Prices fob Baltimore

1 drum to 4900 lbs.	—.1475¢ lb.
5000 lbs. to truckloads	—.1425¢ lb.
Truckloads	—.1375¢ lb.

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Scrap Rubber

Fairly brisk activity characterized the scrap rubber market during the period from September 16 to October 15, with all reclaimers in relatively high gear, and suppliers shipping regularly in an effort to make up last month's backlog of orders. Naugatuck was said to have resumed normal activity.

According to the Bureau of the Census, United States Department of Commerce, June exports of scrap rubber totaled 3,481,721 pounds, value $92,446, compared with May's 4,124,818 pounds, worth $133,436. Imports in June rose to 1,721,233 pounds, value $97,426, compared with May's 1,404,732 pounds, worth $47,947.

Total exports during 1954 were revealed as 30,522,049 pounds, valued at $763,228. Exports during the first half of 1955 were 17,345,942 pounds, valued at $578,734, or a gain of 3,631,970 pounds over the corresponding period of 1954.

Butyl tubes rose about ¼¢ a pound during the period, as did mixed auto tubes. Other prices remained the same.

	Eastern Points	Akron, O.
	(Per Net Ton)	
Mixed auto tires	$12.00/15.00	$15.00/16.00
S. A. G. auto tires	Nom.	13.00
Truck tires	Nom.	14.00
Peelings, No. 1	41.00/42.00	41.00/42.00
2	24.00	24.00
3	15.50	Nom.
Tire buffing	17.00	14.00/15.00
	(¢ per Lb.)	
Auto tubes, mixed	4.75	5.00
Black	5.25/5.50	5.25/5.50
Red	7.00	7.00
Butyl	6.50/6.75	6.50/6.75

Reclaimed Rubber

Business in reclaimed rubber accelerated during the period from September 16 to October 15, with indications strong that the trend to increased sales would continue in the month ahead. One firm, in fact, reported that its September sales were the highest in its history. Reclaimers throughout the industry were supplying Naugatuck in heavy volume, and operations there were expected to be at normal levels by early November. Naugatuck was hit again by floods last month for the second time since mid-August.

As an indication of what is now believed to be a prosperous year in the industry, the consumption ratio of reclaimed to new rubber so far during 1955 is seen to be in advance of the total 1954 ratio, with the increase most apparent in transportation products.

According to the Bureau of the Census, United States Department of Commerce, June exports of reclaimed rubber rose to 2,527,471 pounds, valued at $233,992. Imports during June totaled 56,000 pounds, worth $6,956.

According to the Business & Defense Services Administration, USDC, preliminary statistics for August, in long tons, include the following: production, 25,183; imports, 53; consumption, 25,763; exports, 1,152; and month-end stocks, 27,807.

Prices of whole tires, both first-line and fourth-line, rose fractionally during the period.

RECLAIMED RUBBER PRICES

	Lb.
Whole tire: first line	$0.105
Fourth line	.0925
Inner tube: black	.15
Red	.21
Butyl	.16
Pure gum, light colored	.23
Mechanical, light colored	.135

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

Rayon

Total calculated production of rayon and acetate yarn during September was 74,100,000 pounds, of which 36,000,000 pounds were regular-tenacity yarn and 38,100,000 pounds were high-tenacity yarn. August production had been 72,300,000 pounds, total; 33,500,000 pounds regular-tenacity yarn; and 38,800,000 pounds high-tenacity yarn.

Total shipments for September were 71,300,000 pounds, consisting of 33,100,000 pounds of regular-tenacity yarn, and 38,200,000 of high-tenacity yarn. August shipments had been 73,700,000 pounds, total; 34,800,000 pounds regular-tenacity yarn; and 38,900,000 pounds high-tenacity yarn.

End-of-September stocks were as follows: total yarn, 47,700,000 pounds; regular-tenacity yarn, 42,500,000 pounds; and high-tenacity yarn, 5,200,000 pounds. End-of-August stocks had been: total yarn, 44,900,000 pounds; regular-tenacity yarn, 39,600,000 pounds; and high-tenacity yarn, 5,300,000 pounds.

As an example of the industry's current prosperity, American Enka Corp., New York, N. Y., announced that its net sales for the first 36 weeks of 1955 were $48,856,919, an increase of 28%, compared with $38,074,500 for the first 36 weeks of 1954. Sales of tire yarn were 34% higher, and sales of textile yarn were up about 7%.

Prices per pound of rayon tire yarns and fabrics remained unchanged as follows:

RAYON PRICES

Tire Yarns	
High-Tenacity	
1100/ 480	$0.62
1100/ 490	.62
1150/ 490	.62
1165/ 480	.63
1230/ 490	.62
1650/ 720	.61
1650/ 980	.61
1875/ 980	.61
2200/ 960	.60
2200/ 980	.60
2200/1466	.67
4400/2934	.63
Super-High-Tenacity	
1650/ 720	.64
1900/ 720	.64
Tire Fabrics	
1100/490/2	.72
1650/980/2	.695 / $0.73
2200/980/2	.685

Cotton Fabrics

Trading was active on the industrial fabrics market during the period from September 16 to October 15, with observers noting that deliveries were being slowed down by an accumulating backlog of orders. Wide goods were particularly in heavy demand as such items as wide drills and wide sheeting were ordered in substantial quantities for fourth-quarter delivery. Demand for sateens and broken twills was also high. The delivery position of many mills making better quality and high warp breaking strength goods was seen to be tight. Trading in hose and belting ducks continued on a normal basis, with rubber manufacturers covering ahead about 45 days and in fairly good volume.

Market averages were mostly the same as last month's, with drills, osnaburgs, and some ducks rising fractionally. Period-end prices follow.

COTTON FABRICS

Drills	
59-inch 1.85 yd. *yd.*	$0.395/$0.40
2.25-yd.	.335
Ducks	
38-inch 1.78-yd. S.F. *yd.*	nom.
2.00-yd. D.F.	.31
51.5-inch, 1.35-yd. D.F.	.46⅝/.46¾
Hose and belting	.67
Raincoat Fabrics	
Printcloth, 38½-inch, 64x60, 5.35-yd. *yd.*	.1425
6.25 yd.	.12
Sheeting, 48-inch, 4.17-yd.	.20
52-inch, 3.85-yd.	.235
Osnaburgs	
40-inch 2.11-yd. *yd.*	.2625
3.65-yd.	.165
Chafer Fabrics	
14.40-oz./sq. yd. Pl. *yd.*	.70
11.65-oz./sq. yd. S.	.61
10.80-oz./sq. yd. S.	.6575
8.9-oz./sq. yd. S.	.67
Other Fabrics	
Headlining, 59-inch, 1.65-yd., 2-ply *yd.*	.47
64-inch, 1.25-yd., 2-ply	.595
Sateens, 53-inch, 1.32-yd.	.56
58-inch, 1.21-yd.	.61

Northeastern Section

(*Continued from page 246*)

New Zealand, with favorable balances of trade, could afford even the small trickle of the rubber that finds its way abroad.

To illustrate his talk, Mr. Carver presented colored slides of Japan, Australia, New Zealand, Indonesia, and Fiji.

During the Group's business session, the following slate of candidates was elected: Charles S. Frary, Jr., Boston Woven Hose & Rubber Co., chairman (elected in 1954); John B. Gregory, Frederick S. Bacon Laboratories, chairman-elect; Max Taitel, Union Bay State Laboratories, Inc., secretary-treasurer; and Marvin J. Wilner, Plymouth Rubber Co., Joseph P. Manning, Angier Products, Inc., Henry A. Hill, National Polychemicals, Inc., and Ernst A. Hauser, MIT, members of the executive committee.

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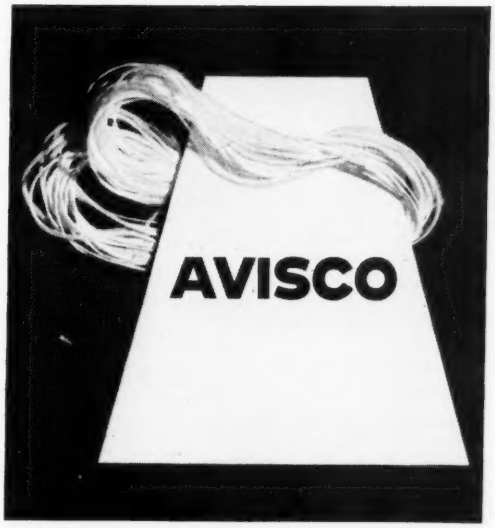

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Synthetic Rubbers and Latices*

Acrylic Types

Hycar 4021	$1.35[a]
4501	.81[a]

Isobutylene Types

Enjay Butyl 035, 150, 215, 217, 218, 325	.23[a]
165, 265, 267, 268, 365	.24[a]
Hycar 2202	.65[a]
Polysar Butyl 100, 200, 300, 400	.23[b]
301	.24[a]
Vistanex	.45[a]

Neoprene

Neoprene Type AC, CG	.55[a]
GN, GN-A	.41[a]
GRT, S	.42[a]
KNR	.75[a]
W	.39[a]
WRT	.45[a]

Latices

Neoprene Latex 571, 842-A	.37[b]
572	.39[a]
601-A	.40[a]
735, 736	.38[a]
950	.47[a]

Nitrile Types

Butaprene NAA	.54[a]
NF	.49[a]
NL	.50[a]
NXM	.58[a]
Chemigum 30N4NS, 50N4NS	.50[a]
N3	.58[a]
Hycar 1001 1041	.58[b]
1002, 1042, 1043	.50[b]
1014, 1312	.60[b]
1411	.62[b]
1432	.59[b]
1441	.64[b]
Paracril AJ	.485[a]
B, BJ, BLT	.50[a]
C	.58[a]
D	.65[a]
1880	.60[a]
Polysar Krynac 800, 803	.50[a]
801	.59[a]

Latices

Butaprene NSP 192	.54[b]
NSP 193	.46[b]

[a] Freight extra.
[b] Minimum freight allowed.
[c] Freight prepaid.

*Prices are per pound carload or tank car dry weight unless otherwise specified.

†Listed below are the new GR-S type synthetic rubbers and latices trade names and the chief sales offices of their producers or distributors.

ASRC —American Synthetic Rubber Corp., 370 Lexington Ave., New York 17, N. Y.

Baytown —United Rubber & Chemical Co., Baytown, Tex. (producer); United Carbon Co., Inc., Charleston 27, W. Va. (distributor).

Butaprene S —Firestone Tire & Rubber Co., Synthetic Rubber Division, 381 Wilbeth Rd., Akron 1, O.

Copo —Copolymer Rubber & Chemical Corp., P. O. Box 1029, Baton Rouge 1, La.

G-G —Goodrich-Gulf Chemicals, Inc., 2060 E. Ninth St., Cleveland 15, O.

Naugapol, Naugatex —Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn.

Philprene —Phillips Chemical Co., Rubber Chemicals Division, 318 Water St., Akron 8, O.

Plioflex —Goodyear Synthetic Rubber Corp., 1144 Market St., Akron 16, O.

Pliolite Latex—Goodyear Synthetic Rubber Corp. Also distributed by General Latex & Chemical Corp., 666 Main St., Cambridge 39, Mass.

Polysar —Polymer Corp., Ltd., Sarnia, Ont., Canada (producer); H. Muehlstein & Co., Inc., 60 E. 42nd St., New York 17, N. Y. (distributor).

S- —Shell Chemical Corp., Synthetic Rubber Sales Division, 30 W 50th St., New York 20, N. Y.

Synpol —Texas-U. S. Chemical Co., Port Neches, Tex. (producer); Naugatuck Chemical (distributor).

Chemigum 200	$0.49[a]
235, 236	.54[a]
245, 246	.46[a]
Hycar 1512, 1552, 1562, 1577	.46[a]
1551, 1561	.54[a]
1571	.59[a]
1572	.51[a]
Nitrex 2612, 2614	.46[b]
2615	.51[b]

Polysulfide Types

Thiokol LP-2, -3, -32, -33	.96[a]
-8, -38	1.25[a]
PR-1	.95[a]
Type-A	.47[a]
FA	.69[a]
ST	1.00[a]

Latices

Thiokol Latex (dry wt.)	
Type MF	.85[a]
MX	.70[a]
WD-2	.92[a]
-5	.95[a]
-6, -7	.70[a]

Silicone Types

GE (compounded)	2.25[a] / $4.10
Silicone gum (not compounded)	4.00[a] / 4.90[a]
Silastic (compounded)	2.30[b] / 4.00[b]

Styrene Types†

Hot GR-S

Butaprene S-1000, -1001, -1004, 1006	.23[a]
-1002, -1005, -1009	.2455[a]
-1010	.245[a]
-1012, -1013	.243[a]
-1014	.248[a]
-1015	.28[a]
G-G 1001, 1006	.241[c]
Naugapol 1016, 1019	.255[b]
1018, 1022	.26[b]
1021	.29[b]
1023	.265[b]
Philprene 1000, 1001, 1006	.25[b]
1009	.255[b]
1018	.2575[b]
1019	.2525[b]
Plioflex 1000, 1006	.2425[c]
Polysar S, S-20, S-50, S-65, S-X-371	.23[a]
SS-250	.30[a]
S-1000, -1001, -1006, -1013	.23[a]
-1002, -1011	.2325[a]
Synpol 1000, 1001, 1006, 1007, 1012	.2425[b]
1002	.245[b]
1009	.2475[b]
1013	.25[b]

Hot GR-S Black Masterbatch

S-1100	.185[a]

Cold GR-S

ASRC-1500, -1502	.241[c]
Butaprene S-1500, -1502	.23[a]
Copo 1500, 1502	.241[c]
G-G 1500, 1501, 1502	.241[c]
Naugapol 1503	.255[b]
1504	.265[b]
Philprene 1500, 1502	.25[b]
1503	.2525[b]
Plioflex 1502	.2425[c]
Polysar Krylene	.23[a]
S-1500, -1501, -1502	.23[b]
Synpol 1500, 1551	.2425[b]

Cold GR-S Black Masterbatch

Baytown 1600, 1601, 1602	.185[a]
Philprene 1600, 1601, 1602	.20[b]
1605	.194[b]
S-1600, -1601, -1602	.185[a]

Cold GR-S Oil Masterbatch

Butaprene S-1703	.195[a]
-1705	.1925[a]
-1710, -1712	.1775[a]
G-G 1703	.206[c]
1705, 1706	.2035[c]
1707	.191[c]
1709, 1710, 1711, 1712	.1885[c]
Philprene 1703	$0.212[b]
1706	.21[b]
1708	.197[b]
1711, 1712	.194[b]
Polysar Krynol	.189[a]
S-1703	.195[a]
-1705, -1706	.1925[a]
-1707	.18[a]
-1709, -1712	.1775[a]
Synpol 1703	.2075[b]
1707	.1925[b]
1708	.195[b]
1710, 1711	.19[b]

Cold GR-S Oil-Black Masterbatch

Baytown 1801	.17[a]
Philprene 1803	.18[b]
S-1801	.17[a]

Hot GR-S Latices

Butaprene S Latex Type 2000, 2001, 2006	.26[a]
2002	.285[a]
2003, 2004	.295[a]
Naugatex 2000, 2001, 2006	.263[a]
2002	.288[a]
2005	.30[a]
S-2000	.2275[a]
-2004	.26[a]

Cold GR-S Latices

Butaprene S Latex Type 2105	.31[a]
Copo 2101	.28[c]
2102, 2105	.31[c]
X-765	.29[c]
Naugatex 2101	.285[a]
2105	.312[a]
X-767	.323[a]
Pliolite Latex 2101	.2775[c]
2104, 2105	.28[c]
X-765	.265[c]
S-2101	.225[a]

●

Goodyear Third to Announce Synthesized Natural Rubber

Synthetic rubber with a molecular structure like that of natural rubber has been developed by The Goodyear Tire & Rubber Co., Akron, O., according to R. P. Dinsmore, vice president in charge of research and development. Similar achievements have previously been announced by two other major American rubber manufacturers, The B. F. Goodrich Co. and The Firestone Tire & Rubber Co.

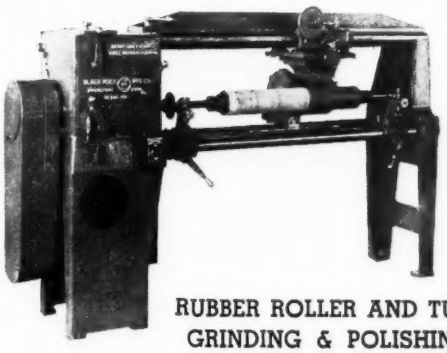
The new rubber's molecular resemblance to the tree product has been confirmed by X-ray and infrared examination, a technique better suited to the purpose than physical evaluation, Dr. Dinsmore said. Performance tests on tires made of the rubber have not yet been completed by the company, but it is believed they will add to the confirmation. The new rubber has not yet been named.

The synthesis was achieved through the use of a catalyst similar to the one first discovered by Karl Ziegler, of the Max Planck Institute for Coal Research in Germany, which is now being used in this country in the impending commercial manufacture of an improved variety of polyethylene.

The Ziegler catalyst differs from those used by other companies to build up basic isoprene to a natural-like synthetic rubber molecule, Dr. Dinsmore pointed out, but each operates in a similar fashion, leading to the speculation that the primary function of the catalyst system is to provide a specific surface on which absorbed monomer polymerizes, with its function as initiator of the polymer chains being secondary.

This may explain how the unique structure of tree-grown rubber can be reproduced through two or more apparently unrelated processes, Dr. Dinsmore declared, adding that if the speculation proves a reality, many other types of solid surface catalysts may be found capable of instituting the synthesis.

A Dual Purpose Machine For Grinding and Polishing



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- NEW, improved LACQUERS for Rubber Footwear, or any rubber product where lacquer is used as a pre-cure coating.
- SOLE and HEEL LACQUERS. Eliminate seconds by using our special pigmented lacquers. Can be supplied in any color desired.
- NCP 1909. An anti-tack coating. Spray or brush it on any tacky surface where powder is normally used to kill tack before cure.
- CASUALS, footwear. NCP 1909 is an excellent dulling and anti-tack agent on edges of soles or crepe wrappers used in the manufacturing of casual type footwear.
- SPECIAL lacquers for all types of rubber products.

Write for complete details

The National Chemical & Plastics Co.
1424 Philpot Street • Baltimore 31, Maryland

WANT THE RIGHT TALC?

Call on Whittaker
"The Talc House"

"MARINE" MAGNESIUM OXIDE
(Maglite M)

•

VALENCIA PUMICE

•

ELK BRAND ANTIMONY OXIDE

WHITTAKER CLARK & DANIELS, INC.
260 West Broadway
New York 13, N. Y.

Compounding Ingredients*

Abrasives

Pumicestone, powdered	lb.	$0.025 /	$0.065
Rottenstone, domestic	lb.	.03 /	.04
Shelblast	ton	80.00 /	165.00
Walnut Shell Grits	ton	50.00 /	160.00

Accelerators

A-1 (Thiocarbanilide)	lb.	.50 /	.57
A-32	lb.	.66 /	.80
A-100	lb.	.52 /	.66
Accelerator 49	lb.	.55 /	.56
108	lb.	.90	
552	lb.	2.25	
808	lb.	.66 /	.68
833	lb.	1.17 /	1.19
Altax	lb.	.50 /	.52
Arazate	lb.	2.25	
Beutene	lb.	.66 /	.71
Bismate	lb.	3.00	
B-J-F	lb.	.27 /	.32
Butasan	lb.	1.04	
Butazate	lb.	1.04	
Butyl Accelerator 21	lb.	.89	
Eight	lb.	1.10 /	1.35
Zimate	lb.	1.04	
Captax	lb.	.40 /	.42
C-P-B	lb.	1.95	
Cumate	lb.	1.45	
Diesterex N	lb.	.50 /	.57
DOTG (diorthotolylguanidine)			
Cyanamid	lb.	.60 /	.61
Du Pont	lb.	.57 /	.58
DPG (diphenylguanidine)			
Cyanamid	lb.	.50 /	.51
Monsanto	lb.	.48 /	.55
El-Sixty	lb.	.58 /	.65
Ethasan	lb.	1.04	
Ethazate	lb.	1.04	
50-D	lb.	.85	
Ethyl Thiurad	lb.	1.04	
Tuads	lb.	1.04	
Tuex	lb.	1.04	
Zimate	lb.	1.04	
Ethylac	lb.	.93 /	.95
Hepteen	lb.	.44 /	.50
Base	lb.	1.85	
Ledate	lb.	1.04	
MBT (2-mercaptobenzothiazole)			
American Cyanamid	lb.	.40 /	.42
Du Pont	lb.	.38 /	.40
Naugatuck	lb.	.40 /	.45
-XXX, Cyanamid	lb.	.51 /	.53
MBTS (mercaptobenzothiazyl disulfide)			
Cyanamid	lb.	.50 /	.52
Du Pont	lb.	.48 /	.50
Naugatuck	lb.	.50 /	.55
-W Cyanamid	lb.	.53 /	.55
Mertax	lb.	.51 /	.58
Methasan	lb.	1.04	
Methazate	lb.	1.04	
Methyl Tuads	lb.	1.14	
Zimate	lb.	1.04	
Monex	lb.	1.14	
Mono-Thiurad	lb.	1.14	
Morfex	lb.	.65 /	.70
MT	lb.	1.00	
NOBS No. 1	lb.	.72 /	.74
Special	lb.	.77 /	.79
O-X-A-F	lb.	.51 /	.56
Pentex	lb.	1.04	
Flour	lb.	.21	
Permalux	lb.	2.17	
Phenex	lb.	.52 /	.59
Pip-Pip		2.07	
R-2 Crystals	lb.	4.35	
Rotax	lb.	.51 /	.53
RZ-50, -50B	lb.	1.00	
S. A. 52	lb.	1.14	
57, 62, 67, 77	lb.	1.04	
66	lb.	2.50	
Santocure	lb.	.72 /	.79
NS	lb.	.78 /	.85
Selenacs	lb.	2.60	
SPDX-GH	lb.	.69 /	.74
GL	lb.	1.20 /	1.34
Tellurac	lb.	1.21	
Tepidone	lb.	.45	
Tetrone A	lb.	1.91	
Thiofide	lb.	.50 /	.57
S	lb.	.52 /	.59
Thionex	lb.	1.14	
Thiotax	lb.	.40 /	.47
Thiurad	lb.	1.14	
Thiuram E	lb.	1.04	
M	lb.	1.14	
Trimene	lb.	.56 /	.62
Base	lb.	1.03 /	1.10
Tuex	lb.	1.14	
Ultex	lb.	1.00 /	1.10
Unads	lb.	1.14	
Ureka Base	lb.	.66 /	.73
Vulcacure NB	lb.	.45	
ZB, ZE, ZM	lb.	.85	
Vulcacure Z-B-X		$2.45	
Zenite	lb.	.48 /	$0.50
A	lb.	.49 /	.51
Special	lb.	.49 /	.51
Zetax	lb.	.51 /	.53
Zimate	lb.	1.04	

Accelerator-Activators, Inorganic

Lime, hydrated	ton	20.21	
Litharge, comml.	lb.	.17 /	.175
Eagle, sublimed	lb.	.171	
National Lead, sublimed	lb.	.17 /	.18
Red lead, comml.	lb.	.18 /	.19
Eagle	lb.	.18	
National Lead	lb.	.18 /	.1925
White lead, carbonate	lb.	.175 /	.19
Eagle	lb.	.18 /	.19
National Lead	lb.	.18 /	.19
Silicate	lb.	.1625 /	.20
Eagle	lb.	.19 /	.2075
National Lead	lb.	.1625 /	.1725
Zinc oxide, comml.†	lb.	.14 /	.1825

Accelerator-Activators, Organic

Aktone	lb.	.22 /	.23
Barak	lb.	.62	
Capital 170	lb.	.2275 /	.2675
171	lb.	.1325 /	.1725
700, 701	lb.	.155 /	.195
705, 710	lb.	.155 /	.195
800	lb.	.12 /	.14
801	lb.	.1375 /	.1575
802	lb.	.1425 /	.1625
803	lb.	.165 /	.185
Curade	lb.	.57 /	.59
D-B-A	lb.	1.95	
Emery 600	lb.	.1325 /	.1725
Groco 30	lb	.1325 /	.1725
35	lb.	.1375 /	.1775
Guantal	lb.	.57 /	.64
Hyfac 400	lb.	.1138 /	.1400
430	lb.	.1563 /	.1825
431	lb.	.1788 /	.205
Hystrene S-97	lb	.1863 /	.2125
T-45	lb.	.1638 /	.19
T-70	lb.	.1738 /	.20
Industrene B	lb.	.1263 /	.1525
R	lb.	.1138 /	.14
158	lb.	.1313 /	.1575
254	lb.	.1413 /	.1675
262	lb.	.1513 /	.1775
Laurex	lb.	.33 /	.37
MODX	lb.	.295 /	.345
NA-22	lb.	1.50	
Oleic acid, comml.	lb.	.16 /	.225
Emersol 210 Flaine	lb.	.16 /	.20
Groco 2, 4, 8, 18	lb.	.16 /	.20
Plastone	lb.	.27 /	.30
Polyvac	lb.	1.65	
Ridacto	lb.	.25 /	.26
Seedine	lb.	.1485 /	.1703
Stearex Beads	lb.	.1488 /	.1588
Stearic acid			
Emersol 120	lb.	.1413 /	.1675
130	lb.	.1638 /	.19
Hydrofol 51	lb.	.09	
Hydrogenated, rubber grd.			
Groco	lb.	.12 /	.14
Rufat 75	lb.	.1138 /	.14
Single pressed, comml.	lb.	.1425 /	.1625
Emersol 110	lb.	.1363 /	.1625
Groco 53	lb.	.1425 /	.1625
Wilmar 253	lb.	.1363 /	.1625
Double pressed, comml.	lb.	.1475 /	.1675
Groco 54	lb.	.1475 /	.1675
Wilmar 254	lb.	.1413 /	.1675
Triple pressed, comml.	lb.	.17 /	.19
Groco 55	lb.	.17 /	.19
Wilmar 255	lb.	.1638 /	.19
Sterene 60-R	lb.	.09 /	.1075
Tonox	lb.	.515 /	.605
Vulklor	lb.	.88 /	1.08
Wilmar 110	lb.	.16 /	.20
434	lb.	.1325 /	.1725
Zinc stearate, comml.	lb.	.37 /	.42

Antioxidants

AgeBest A26	lb.	.18 /	.24
620-32B	lb.	.20 /	.26
716-30	lb.	.18 /	.24
1041-21	lb.	.165 /	.225
1293-22A	lb.	1.90 /	2.00
AgeRite Alba	lb.	2.35 /	2.45
Gel	lb.	.64 /	.66
H. P.	lb.	.72 /	.74
Hipar	lb.	.98 /	1.00
Powder	lb.	.52 /	.54
Resin	lb.	.75 /	.77
D	lb.	.52 /	.54
Spar	lb.	.52 /	.54
Stalite	lb.	.52 /	.54
S	lb.	.52 /	.54
White	lb.	1.45 /	1.55
Akroflex C	lb.	.77 /	.79
CD	lb.	.72 /	.74
Albasan	lb.	.69 /	.73
Allied AA-1144	lb.	.23 /	.24
AA-1177	lb.	.155 /	.165
Aminox	lb.	.52 /	.57
Antioxidant 425	lb.	2.47 /	2.50
2246	lb.	1.50 /	1.53
Antisol	lb.	$0.23 /	$0.24
Antisun	lb.	.15 /	.175
Antox	lb.	.52 /	.54
Aranox	lb.	3.25	
Betanox Special	lb.	.80 /	.85
B-L-E, -25	lb.	.52 /	.57
Burgess Antisun Wax	lb.	.185	
B-X-A	lb.	.52 /	.57
Copper Inhibiter X-872-L	lb.	2.01	
D-B-P-C	lb.	.91 /	1.16
Flectol H	lb.	.52 /	.59
Flexamine	lb.	.72 /	.77
Heliozone	lb.	.26 /	.27
Ionol	lb.	.91 /	1.40
NBC	lb.	1.55	
Neozone A	lb.	.56 /	.58
D	lb.	.52 /	.54
Octamine	lb.	.52 /	.57
PDA-10	lb.	.46 /	.48
Perflectol	lb.	.61 /	.68
Polygard	lb.	.52 /	.57
Protector	lb.	.26 /	.31
Rio Resin	lb.	.60 /	.62
Santoflex 35	lb.	.72 /	.79
75	lb.	.92 /	.99
AW	lb.	.78 /	.85
B	lb.	.52 /	.59
BX	lb.	.63 /	.70
DD	lb.	.52 /	.59
Santovar A	lb.	1.50 /	1.57
Santowhite Crystals, Powder	lb.	1.60 /	1.67
L	lb.	.52 /	.59
MK	lb.	1.29 /	1.36
Sharples Wax	lb.	.23 /	.28
Stabilite	lb.	.55 /	.59
Alba	lb.	.72 /	.79
L	lb.	.60 /	.64
White	lb.	.52 /	.60
Powder	lb.	.41 /	.47
Styphen I	lb.	.51 /	.55
Sunolite #100	lb.	.21 /	.23
#127	lb.	.17 /	.19
Sunproof -713	lb.	.25 /	.30
Improved	lb.	.25 /	.30
Jr.	lb.	.20 /	.25
Thermoflex A	lb.	.98 /	1.00
Tonox	lb.	.52 /	.57
Tysonite	lb.	.24 /	.2475
Velvapex 51-250	lb.	.40	
V-G-B	lb.	.70 /	.70
Wing-Stay S	lb.	.52 /	.61
Zenite	lb.	.48 /	.55

Antiseptics

Copper naphthenate, 6-8%	lb.	.24	
Pentachlorophenol	lb.	.21 /	.29
Resorcinol, technical	lb.	.775 /	.785
Zinc naphthenate, 8-10%	lb.	.245 /	.30

Blowing Agents

Ammonium bicarbonate	lb.	.065 /	.085
Carbonate	lb.	.16	
Blowing Agent CP-975	lb.	.35	
Celogen	lb.	1.95	
50-C	lb.	1.01 /	1.07
Sodium bicarbonate	100 lbs.	2.70 /	3.30
Carbonate tech.	100 lbs.	1.35 /	5.52
Sponge Paste	lb.	.20	
Unicel	lb.	.90	
ND	lb.	.76	
S	lb.	.20	

Bonding Agents

Braze	gal.	6.00 /	9.00
Cover cement	gal.	2.50 /	4.00
Flocking Adhesive RFA17, RFA22, RFA25	lb.	.50	
G-E Silicone Paste SS-15	lb.	4.52 /	5.10
SS-64	lb.	3.65 /	6.75
-67 Primer	lb.	7.50 /	12.50
Gen-Tac Latex	lb.	.75 /	.855
Kalabond Adhesive	gal.	6.50 /	16.00
Tie Cement	gal.	2.00 /	5.60
MDI	lb.	4.00 /	6.00
-50	lb.	2.00 /	3.00
Thixons	gal.	1.48 /	12.00
Ty Ply BN, Q, S, UP, 3640	gal.	6.75 /	8.00
RC	gal.	3.75 /	5.00

Brake Lining Saturants

BRT 3	lb.	.018 /	.0265
Resinex L-S	lb.	.0225 /	.03

Carbon Blacks‡

Conductive Channel—CC

Continental R-40	lb.	.23 /	.30
Kosmos/Dixie BB	lb.	.23 /	.30
Spheron C	lb.	.14 /	.185
Voltex	lb.	18 /	.315

Easy Processing Channel—EPC

Continental AA	lb.	.074 /	.1225
Kosmobile 77/Dixiedensed 77	lb.	.074 /	.1225
Micronex W-6	lb.	.074 /	.1225
Spheron #9	lb.	.074 /	.1225
Texas E	lb.	.074 /	.1225
Witco #12	lb.	.074 /	.1225
Wyex	lb.	.074 /	.12

Hard Processing Channel—HPC

Continental F	lb.	.074 /	.1225
HX	lb.	.074 /	.12
Kosmobile S/Dixiedensed S	lb.	.074 /	.1225

* Prices, in general, are f.o.b. works. Range indicates grade or quantity variations. No guarantee of these prices is made. Spot prices should be obtained from individual suppliers.

† For trade names, see Color—White, Zinc Oxides.

‡ At the request of the suppliers, the lowest prices shown for carbon blacks are for carloads in bags. Prices for hopper carloads are lower.

CLASSIFIED ADVERTISEMENTS

ALL CLASSIFIED ADVERTISING MUST BE PAID IN ADVANCE

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Light face type $1.25 per line (ten words)
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Allow nine words for keyed address.

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Light face type 40c per line (ten words)
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SITUATIONS OPEN RATES

Light face type $1.00 per line (ten words)
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Letter replies forwarded without charge, but no packages or samples.

Address All Replies to New York Office at 386 Fourth Avenue, New York 16, N. Y.

SITUATIONS OPEN

RUBBER CHEMIST WANTED

EXCELLENT OPPORTUNITY FOR ADVANCEMENT IN FAST GROWING CENTRAL INDIANA INDUSTRY
IDEAL WORKING CONDITIONS
COLLEGE DEGREE REQUIRED
EXPERIENCE PREFERRED BUT NOT NECESSARY

REPLY WITH COMPLETE RESUME TO:
PERSONNEL DIRECTOR
ANACONDA WIRE & CABLE COMPANY
MARION, INDIANA

RUBBER CHEMISTS

Degree in chemistry or chemical engineering. Up to five years' experience in rubber and polymer processing, development or production. Progressive company, well-equipped laboratory; permanent position with opportunity for advancement in expanding operation. Write giving age, experience, and education. Replies held confidential. Address Box 369, Erie, Pennsylvania.

WANTED

MANUFACTURER'S AGENT for line of Neoprene and Hypalon protective coatings. Eastern seaboard and midwestern states. Address Box 1799, care of RUBBER WORLD.

CHIEF RUBBER CHEMIST TO TAKE CHARGE OF OUR mechanical rubber goods compounding operation. Will report directly to our Technical Director and supervise the activities of our laboratory personnel. Salary open. Replies will be confidential. Contact: Personnel Manager, THE SUN RUBBER COMPANY, Barberton, Ohio.

PERSONNEL SPECIALISTS TO THE RUBBER INDUSTRY

Administrative, Sales, Technical and Production Supervision
Write or phone Leslie E. King, Manager Rubber and Technical Divs.

AKRON EMPLOYMENT SERVICE

Suite 607-08 Metropolitan Building, Akron, Ohio. PArtage 2-7641
Member: Chamber of Commerce, Ohio Private Employment Agencies Association and National Association of Personnel Consultants with 51 affiliate private agencies covering 26 states.

LATEX CHEMIST—IMMEDIATE OPENING TO DIRECT LABoratory in compounding natural and synthetic latices for coatings and adhesives. Challenging position with excellent growth potential. Knowledge of resin emulsions valuable, but not essential. Located Boston area. Salary open. Send complete résumé. Address Box No. 1800, care of RUBBER WORLD.

YOUNG CHEMISTS WILL HAVE A CHANCE TO GROW WITH a highly successful company in an expanding industry by joining the Armstrong organization to be trained in rubber compounding for tire manufacturing. Relocation required. Send résumés to G. R. Millar, The Armstrong Rubber Company, West Haven, Connecticut.

CHEMIST OR CHEMICAL ENGINEER

Wanted by large mechanical goods manufacturer; New York City area. Experience in practical compounding of Rubber, GR-S, and other Polymers required. In replying, outline education, experience, and salary desired. Replies held in strict confidence. Address Box No. 1801, care of RUBBER WORLD.

RUBBER MILL ROOM FOREMAN, WITH WORKING KNOWledge of compounding, Banbury operation, milling and extruding, as well as stock handling. Firm located northern New England. A growing business offering challenge and opportunity. Business primarily mechanical goods, O-rings, seals, etc. Address Box No. 1802, care of RUBBER WORLD.

MAINTENANCE ENGINEER FOR PLASTIC CALENDERS, mills, Banbury. Must be experienced. Address Box No. 1803, care of RUBBER WORLD.

SITUATIONS OPEN (Continued)

INDUSTRY MANAGER FOR THE SALES AND APPLICATION of measurement and control equipment to the rubber industry. An engineer with sales and sales management experience with a capital equipment supplier for the industry. Exceptional opportunity with manufacturer of ACCU-RAY. Send résumé. INDUSTRIAL NUCLEONICS CORPORATION, 1205 Chesapeake Avenue, Columbus 12, Ohio.

CHIEF LATEX CHEMIST TO DIRECT SOUTHERN MANUfacturing division of latex compounds for textile industry. Must be tops on compound experience and development. Excellent opportunity in established growing concern. State fully qualifications and requirements. Address Box No. 1804, care of RUBBER WORLD.

TECHNICAL SALES REPRESENTATIVE

Technical sales position open for man experienced in rubber cements and adhesives field. Should be free to travel eastern part of country. Salary commensurate with ability and experience. Write full details to Box No. 1806, care of RUBBER WORLD. Replies kept confidential.

CHEMIST (RUBBER) INDUSTRIAL RUBBER "O" RING AND packing manufacturer desires Chemist between 25 and 35 with at least three years' experience in Rubber Chemistry for Research and Development work assisting Chief Chemist. Location—Midwest. Please give education, experience, background, salary, etc. to Box No. 1807, care of RUBBER WORLD.

WANTED: RUBBER CHEMIST WITH EXPERIENCE IN OPENcell sponge. AAA-1 company. Plant located in Chicago area. Address Box No. 1808, care of RUBBER WORLD.

RUBBER CHEMIST

AAA-1 CENTRAL WEST MANUFACTURER has position for man with experience in developing and producing sponge from natural and synthetic rubber. Must have proven ability. Send résumé and salary desired with first letter. Our technical staff knows of this advertisement. Address Box No. 1809, care of RUBBER WORLD.

RUBBER CHEMISTS

A fast-growing and progressive organization in the Midwest has opportunities for experienced graduate chemists and chemical engineers in resin and rubber adhesive coatings. Assignments include product development of pressure-sensitive tapes in a modern and well-equipped laboratory and follow-through in pilot and production plants. Excellent working conditions; salary commensurate with experience. Send complete résumé with first letter. All replies held in strict confidence. Address Box 1810, care of RUBBER WORLD.

WORKING CHEMIST WITH MOLDING EXPERIENCE FOR manufacture of rubber parts for brewery equipment. Fine opening for practical man with general experience with Natual Rubber. Old established company in Chicago section. Replies confidential. Address Box No. 1811, care of RUBBER WORLD.

DEVELOPMENT ENGINEER FOR PRODUCT DESIGN ON HOSE and belting wanted by major mechanical rubber goods company in Great Lakes Area. Excellent opportunity for man interested in pursuing all phases of development design and free from routine factory problems. Replies confidential. Our employes know of this ad. Address Box 1812, care of RUBBER WORLD.

PLANT MANAGER
FOR
PRECISION MOLDED GOODS

New and modern Northeastern Ohio manufacturer requires man with technical, production, and general administrative ability. All replies confidential. Address Box No. 1813, care of RUBBER WORLD.

ASSISTANT ELECTRICAL ENGINEER

With electronic or communication training or experience. In reply give full résumé of education, experience, and salary requirements to Whitney Blake Company, 1565 Dixwell Avenue, Hamden, Connecticut.

SITUATIONS WANTED

GENERAL MANAGER

Works Manager having had extensive successful experience in all phases of rubber manufacturing seeks challenging new opportunity as General Manager or Vice President of single or multi-plant operations. Best references. Address Box No. 1805, care of RUBBER WORLD.

MACHINERY & SUPPLIES WANTED

WANTED: PLANT OR MACHINERY INCL. RUBBER MILLS, Calenders, Mixers, Banbury Mixers, Extruders, Grinders, Cutters, Hydraulic Presses, Injection Molding Machines. CONSOLIDATED PRODUCTS CO., INC., 64 Bloomfield Street, Hoboken, N. J. BArclay 7-0600.

BALL & JEWELL ROTARY CUTTER, ROLLER BEARING #1½ or 2. Give full details and price in first letter. Address Box No. 1814, care of RUBBER WORLD.

Micromex Mk. II	lb.	$0.074 /	$0.1225
Spheron #4	lb.	.074 /	.1225
Witco #6	lb.	.074 /	.1225
Medium Processing Channel—MPC			
Arrow TX	lb.	.074 /	.12
Continental A	lb.	.074 /	.1225
Kosmobile S-66/Dixiedensed S-66	lb.	.074 /	.1225
Micronex Standard	lb.	.074 /	.1225
Spheron #6	lb.	.074 /	.1225
Texas 109	lb.	.079 /	.1275
M	lb.	.074 /	.1225
Witco #1	lb.	.074 /	.1225
Conductive Furnace—CF			
Aromex 115	lb.	.089 /	.129
Vulcan C	lb.	.105 /	.15
SC	lb.	.18 /	.223
Fast Extruding Furnace—FEF			
Arovel	lb.	.06 /	.10
Continex FEF	lb.	.06 /	.10
Kosmos 50/Dixie 50	lb.	.06 /	.10
Statex M	lb.	.06 /	.10
Sterling SO	lb.	.06 /	.10
Fine Furnace—FF			
Statex B	lb.	.065 /	.105
Sterling 99	lb.	.065 /	.105
High Abrasion Furnace—HAF			
Aromex	lb.	.079 /	.119
Continex HAF	lb.	.079 /	.125
Kosmos 60/Dixie 60	lb.	.079 /	.1175
Philblack O	lb.	.079 /	.119
Statex R	lb.	.079 /	.125
Vulcan #3	lb.	.079 /	.125
Intermediate Super Abrasion Furnace—ISAF			
Aromex 125	lb.	.10 /	.14
Kosmos 70/Dixie 70	lb.	.10 /	.145
Philblack I	lb.	.10 /	.145
Statex 125	lb.	.10 /	.145
Vulcan 6	lb.	.10 /	.145
Medium Abrasion Furnace—MAF			
Philblack A	lb.	.06 /	.10
Super Abrasion Furnace—SAF			
Philblack E	lb.	.125 /	.165
Vulcan 9	lb.	.125 /	.168
General-Purpose Furnace—GPF			
Arogen GPF	lb.	.05 /	.09
Sterling V	lb.	.05 /	.09
V Non-staining	lb.	.05 /	.09
High Modulus Furnace—HMF			
Continex HMF	lb.	.055 /	.095
Kosmos 40/Dixie 40	lb.	.055 /	.095
Modulex	lb.	.055 /	.095
Statex 93	lb.	.055 /	.095
930	lb.	.047 /	.087
Sterling L, LL	lb.	.055 /	.095
Semi-Reinforcing Furnace—SRF			
Continex SRF	lb.	.045 /	.085
Essex	lb.	.045 /	.085
Furnex	lb.	.0475/	.0875
Gastex	lb.	.0525/	.0925
Kosmos 20/Dixie 20	lb.	.045 /	.085
Pelletex, NS	lb.	.0475/	.0875
Sterling NS, S	lb.	.0475/	.0875
R	lb.	.0525/	.0925
Fine Thermal—FT			
P-33	lb.	.055	
Sterling FT	lb.	.055	
Medium Thermal—MT			
Sterling MT	lb.	.04	
Non-staining	lb.	.05	
Thermax	lb.	.04	
Stainless	lb.	.05	

Colors

Black

Iron oxides, comml	lb.	.1275/	.13
BK—Lansco	lb.	.1275/	.13
Williams	lb.	.1325/	.135
Lansco synthetic	lb.	.10 -	
Mapico	lb.	.1275/	.13
Lampblack, comml	lb.	.16 /	.45
Superjet	lb.	.0825/	.1175
Permanent Blue	lb.	.80 /	1.05
Stan-Tone	lb.	.45 /	1.20
Vansul masterbatch	lb.	.60 /	.65
Paste	lb.	.14 /	.15

Blue

Du Pont	lb.	1.77 /	4.55
Filo	lb.	.28	
Heveatex pastes	lb.	.80 /	1.45
Lansco ultramarines	lb.	.25 /	.28
Monsanto Blue 7	lb.	1.55	
11	lb.	3.45	
DPB-283	lb.	1.93	
S-11	lb.	2.05	
Permanent Blue	lb.	.80 /	1.05
Stan-Tone	lb.	1.55 /	1.60
Vansul masterbatch	lb.	.90 /	2.70

Brown

Filo	lb.	$0.13	
Iron oxides, comml	lb.	.1375/	$0.14
Lansco synthetic	lb.	.125	
Mapico Brown	lb.	.1375/	.14
Brown 422	lb.	.14	
Sienna, burnt, comml	lb.	.0425/	.155
Williams	lb.	.11 /	.1725
Raw, comml	lb.	.045 /	.1325
Williams	lb.	.08 /	.1725
Umber, burnt, comml	lb.	.06 /	.07
Williams	lb.	.0675/	.08
Raw, comml	lb.	.0625/	.07
Williams	lb.	.07 /	.0825
Williams, pure brown	lb.	.1425/	.145
Vandyke	lb.	.12	
Mapico Tan 20	lb.	.2025/	.205
Tan 15	lb.	.205	
Metallic brown	lb.	.045 /	.055
Vansul masterbatch	lb.	2.10 /	2.20

Green

Chrome	lb.	.19 /	.50
Oxide	lb.	.3925/	1.10
G-4099, -6099	lb.	.42	
GH-9869	lb.	1.05 /	1.20
9976	lb.	1.15 /	1.30
Green	lb.	.80 /	2.40
Du Pont	lb.	1.97 /	2.80
Filo	lb.	.40	
Heveatex pastes	lb.	.95 /	1.85
Lansco Toner	lb.	1.35	
Monsanto Green 3	lb.	2.75	
14	lb.	1.45	
17	lb.	3.95	
71205	lb.	1.35	
DGP	lb.	2.03	
S-17	lb.	2.25	
Stan-Tone	lb.	1.75 /	4.60
Vansul masterbatch	lb.	2.00 /	2.60

Orange

Du Pont	lb.	2.75	
Monsanto Orange 68187	lb.	2.90	
Stan-Tone	lb.	.70 /	3.35
Vansul masterbatch	lb.	2.00 /	2.60

Red

Antimony trisulfide	lb.	.285 /	.315
R. M. P. No. 3	lb.	.72	
Sulfur Free	lb.	.78	
Cadmium red lithopone	lb.	1.99 /	3.05
Cadmolith	lb.	1.72 /	2.20
Cyanamid	lb.	.85	
Du Pont	lb.	1.47 /	1.80
Filo	lb.	.11	
Indian Red	lb.	.1275	
Iron oxide, comml	lb.	.06 /	.13
Lansco synthetic	lb.	.1175	
Mapico	lb.	.1275/	.13
Recco	lb.	.12	
Williams Red	lb.	.1275/	.15
Monsanto Maroon 113	lb.	1.50	
61148	lb.	1.75	
Red 7	lb.	1.55	
41	lb.	4.40	
3501	lb.	1.15	
4004	lb.	1.50	
69191	lb.	3.38	
Autumn	lb.	1.10	
PRP-285	lb.	1.27	
S-44	lb.	1.28	
Rub-Er-Red	lb.	.0975	
Stan-Tone	lb.	.85 /	4.05
Tuscan	lb.	.15 /	.46
Vansul masterbatch	lb.	.95 /	3.30
Venetian	lb.	.035 /	.0625

White

Antimony oxide	lb.	.27 /	.305
Burgess Iceberg	ton	50.00 /	80.00
Cryptone BT	lb.	.10 /	.11
Permolith	lb.	.075 /	.085
Titanium pigments			
Ravox LW	lb.	.195 /	.205
R-110	lb.	.215 /	.225
Ti-Cal	lb.	.075 /	.0825
Ti-Pure	lb.	.195 /	.225
Titanox A, AA, A-168	lb.	.21 /	.22
C-50	lb.	.1225 /	.1275
RA, -10, -50	lb.	.23 /	.24
RC	lb.	.0825 /	.0875
-HT, -HTX	lb.	.08 /	.085
Unitane	lb.	.225 /	.255
Zonaque Anatase	lb.	.225 /	.235
Rutile	lb.	.245 /	.255
Zinc oxide, comml	lb.	.135 /	.1775
Azo ZZZ-11, -44, -55	lb.	.14 /	.16
20% leaded	lb.	.1435 /	.1635
35% leaded	lb.	.14625/	.16625
50% leaded	lb.	.14875/	.16875
Eagle AAA, lead free	lb.	.14 /	.15
5% leaded	lb.	.14 /	.15
35% leaded	lb.	.14625/	.15625
50% leaded	lb.	.14875/	.15875
Florence Green Seal	lb.	.1575 /	.1675
Red Seal	lb.	.1525 /	.1625
White Seal	lb.	.1625 /	.1725
Horsehead XX-4, -78	lb.	.135 /	.145
Kadox-15, -17, -72, -515	lb.	.14 /	.15
-25	lb.	.1625 /	.1725
Lehigh, 35% leaded	lb.	.14625/	.15625
50% leaded	lb.	.14875/	.15875
Protox-166, -167	lb.	.14 /	.15
St. Joe, lead free	lb.	.118 /	.16
Zinc sulfide, comml	lb.	.253 /	.263
Cryptone ZS	lb.	.253 /	.263

Yellow

Cadmium yellow lithopone	lb.	$1.15	
Cadmolith	lb.	1.12 /	$1.20
Du Pont	lb.	1.80 /	2.15
Filo	lb.	.10	
Iron oxide, comml	lb.	.0525/	.1075
Lansco synthetic	lb.	.1075	
Mapico	lb.	.105 /	.1075
Williams	lb.	.11 /	.1175
Monsanto Yellow 14	lb.	1.91	
10010	lb.	1.91	
BYP-282	lb.	1.21	
GA	lb.	2.45	
S-10010	lb.	1.17	
Stan-Tone	lb.	1.00 /	1.55
Vansul masterbatch	lb.	.95 /	1.95
Williams Ocher	lb.	.0525/	.055

Dusting Agents

Diatomaceous silica	ton	32.00 /	48.00
Extrud-o-Lube, conc	gal.	1.54 /	1.69
Glycerized Liquid Lubricant, concentrated	gal.	1.48 /	1.63
Latex-Lube GR	lb.	.20	
Pigmented	lb.	.1825	
R-66	lb.	.165	
Liqui-Lube	lb.	.1625	
N. T.	lb.	.1675	
Liquizinc No. 305	lb.	.30 /	.35
Lubrex	lb.	.25 /	.30
Mica Concord	lb.	.075 /	.0825
Mineralite	ton	45.00	
Pyrax A	ton	13.50	
W. A.	ton	16.00	
Talc, comml	ton	18.40 /	38.50
EM	ton	11.00 /	63.00
LS Silver	ton	29.25	
Nytals	ton	25.00 /	36.00
Sierra Sagger 7	ton	34.00	
White IR	ton	19.75	
III	ton	20.75	
Vanfre	gal.	2.00 /	

Extenders

BRS 700	lb.	.02 /	.0285
BRT 7	lb.	.03 /	.031
Cumar Resins	lb.	.065 /	.17
Dielex B	lb.	.06	
Factice, Amberex	lb.	.29 /	.36
Brown	lb.	.1425/	.268
Neophax	lb.	.157 /	.268
White	lb.	.144 /	.285
G. B. Asphaltenes	lb.	.06 /	.065
Millex, W	lb.	.07	
Mineral Rubbers			
Black Diamond	ton	38.00 /	40.00
Hard Hydrocarbon	ton	46.50 /	48.50
Hydrocarbon MR	ton	45.00 /	55.00
Parmr	ton	21.00 /	29.00
T-MR Granulated	ton	47.50 /	50.00
Nuba No. 1, 2	lb.	.0575/	.0625
3X	lb.	.0775/	.0825
OPD-101	lb.	.26	
Rubber substitute, brown	lb.	.1835/	.2012
Car-Bel-Ex A	lb.	.14	
Car-Bel-Lite	lb.	.35	
Extender 600	lb.	.1765	
White	lb.	.148 /	.256
Stan-Shells	ton	35.00 /	73.00
Sublac Resin PX-5	lb.	.215 /	.235
Synthetic 100	lb.	.41	
Vistanex	lb.	.45 /	.475

Fillers, Inert

Agrashell flour	ton	50.00 /	74.00
Barytes, floated, white	ton	41.60 /	60.10
Off-color, domestic	ton	25.00	
No. 1	ton	41.35 /	60.10
2	ton	39.35 /	58.00
Sparmite	ton	75.00 /	80.00
Blanc fixe	ton	100.00 /	165.00
Burgess Iceberg	ton	50.00 /	80.00
Pigment #20	ton	35.00 /	60.00
#30	ton	37.00 /	60.00
HC-75	ton	12.00 /	30.00
-80	ton	14.00 /	32.00
WP #1	ton	11.00 /	16.00
Cary #200	ton	30.00 /	55.00
Citrus seed meal	lb.	.04	
Oil	lb.	.15	
Clays, Aiken	ton	14.00	
Albacar	ton	50.00 /	55.00
Aluminum Flake	ton	20.00 /	60.00
#5	ton	23.50 /	30.00
Champion	ton	14.00	
Crown	ton	14.00 /	33.00
Dixie	ton	14.00	
Franklin	ton	13.50 /	35.25
GK Soft Clay	ton	11.00	
Hi-White R	ton	13.50	
Hydratex R	ton	28.00	
Kaolloid	ton	10.50	
Laminar	ton	30.00	
Paragon	ton	13.50 /	31.50
McNamee	ton	13.50	
RX-43	ton	33.00	
Recco	ton	14.00	
Sno-Brite	ton	12.50	
Stan-Clay	ton	28.00	
Stellar-R	ton	50.00	
Suprex	ton	14.00 /	32.00
Swanee	ton	12.50	
Windsor	ton	14.00 /	30.00
Diatomaceous silica	ton	32.00 /	48.00
Flocks			
Cotton, dark	lb.	.095 /	.135
Dyed	lb.	.55 /	.60
White	lb.	.13 /	.33

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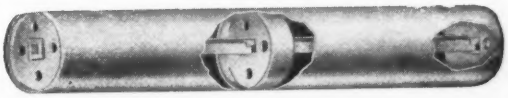
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Fabrifil X-24-G	lb.	$0.135	
X-24-W	lb.	.235	
Filfloc 6000	lb.	.33	
F-40-900	lb.	.135	
HSC #35 Silicone Emulsion	lb.	1.36 /	$3.50
Kalite	ton	50.00 /	65.00
Lithopone, comml.	lb.	.075 /	.085
Albalith	lb.	.075 /	.085
Astrolith	lb.	.06½ /	.0675
Eagle	lb.	.0725/	.075
Sunolith	lb.	.075 /	.0825
Mica Concord	lb.	.075 /	.0825
Millical	ton	35.00 /	50.00
Mineralite	ton	40.00 /	60.00
Non-Fer-Al	ton	30.00 /	45.00
Purecal	ton	56.75 /	71.75
Pyrax A	ton	13.50	
W. A.	ton	16.00	
Sawdust	ton	14.00 /	35.00
Stan-White	ton	8.50 /	9.45
Super-White Silica	ton	23.00 /	43.00
Suspenso	ton	33.00 /	48.00
Ti-Cal	lb.	.0675	
Valron estersil	lb.	1.00	
Whiting, limestone			
Atomite	ton	30.00	
Calcite	ton	21.50	
Keystone	ton	16.00	
Omya	ton	30.00	
Paxinosa	ton	10.00 /	18.00
Snowflake	ton	17.00 /	18.00
Stonelite	ton	9.00	
Witco	ton	8.50	
York	ton	9.50	

Finishes

Apex Bright Finish #5200-E	lb.	.25	
Rubber Finish	gal.	2.50	
Black-out	gal.	4.50 /	8.00
Flocks, Rayon, colored	lb.	.90 /	1.50
White	lb.	.75 /	1.25
Also see Flocks, under Fillers, Inert			
Rubber lacquer, clear	gal.	1.00 /	2.00
Shellacs, Angelo	lb.	.485 /	.7325
Vac Dry	lb.	.485 /	.57
Talc (*See Talc, under Dusting Agents*)			
Unidip	lb.	.15 /	.20
Wax, Bees	lb.	.64 /	.76
Carnauba	lb.	.56 /	1.03
Montan	lb.	.30 /	.32
No. 118, colors	gal.	.86 /	1.41
Neutral	gal.	.76 /	1.31
Van Wax	gal.	1.45 /	1.50

Latex Compounding Ingredients

Acintol D, DLR	lb.	.06 /	.075
FA #1	lb.	.065 /	.08
#2	lb.	.075 /	.09
Accelerator 552	lb.	2.25	
J-117, -302	lb.	1.00 /	1.15
-144	lb.	.15 /	.30
-307	lb.	1.10 /	1.25
-311	lb.	.60 /	.75
Aerosol, dry types	lb.	.39 /	1.20
Liquid types	lb.	.40 /	.72
Alcogum AN-6	lb.	.05	
AN-10	lb.	.085	
Alrosol	lb.	.41	
Alrowet D-75	lb.	.63	
Amberex solutions	lb.	.1675/	.18
Antifoam J-114	lb.	3.25 /	3.45
P-242	lb.	.24 /	.35
Antioxidant J-137, -140	lb.	.55 /	.70
-139, -293	lb.	1.45 /	1.60
-182	lb.	2.00 /	2.15
-186	lb.	1.40 /	1.55
2246	lb.	1.50 /	1.53
Anti Webbing Agent J-183	lb.	.75 /	.90
-297	lb.	.27 /	.40
Aquablak B	lb.	.0925/	.0975
G	lb.	.105 /	.11
K	lb.	.1075/	.1125
M	lb.	.085 /	.09
Aquarex D	lb.	.78	
G	lb.	.21	
L. ME	lb.	.94	
MDL	lb.	.33	
NS	lb.	.60	
SMO	lb.	.50	
WAQ	lb.	.23	
Areskap 50	lb.	.30 /	.38
100, dry	lb.	.60 /	.72
Aresket 240	lb.	.30 /	.38
300, dry	lb.	.60 /	.72
Aresklene 375	lb.	.42 /	.57
Ben-A-Gels	lb.	.98 /	1.40
Bentone 18, 18C	lb.	.45	
34	lb.	.60	
Casein	lb.	.22	
Cellosize WP-09, -3, -300	lb.	1.36 /	1.60
CW-12	lb.	.85	
37	lb.	.70	
Defoama W-1701	lb.	.125	
Defoamer 115a	lb.	.50	
Dispersing Agents			
Blancol	lb.	.1525/	.26
N	lb.	.155 /	.26
Darvan Nos. 1, 2, 3	lb.	.22 /	.30
Daxad 11, 21, 23, 27	lb.	.08 /	.30
Dispersaid H7A	lb.	.58	
1159	lb.	.43	
Empulphor ON-870	lb.	.50 /	.70
Igepal CO-630	lb.	.2875/	.47
Igepon T-73	lb.	.285 /	.495
T-77	lb.	.45 /	.69
Indulins	lb.	.06 /	.08
Kreelons	lb.	.132 /	.155
Laurelton Oil	lb.	.18	
Leonil SA	lb.	$0.52 /	$0.65
Lomar PW	lb.	.18	
Marasperse CB	lb.	.1225/	.1425
N	lb.	.095 /	.105
Modicols	lb.	.17 /	.58
Nekal BA-75	lb.	.395 /	.54
BX-76	lb.	.63 /	.75
Pluronics	lb.	.335 /	.40
Polyfons	lb.	.08 /	.09
Sorapon SF-78	lb.	.28 /	.40
Tergitol NPX	lb.	.275 /	.3074
TMN	lb.	.2875/	.32
7	lb.	.4125/	.44
Trenamine	lb.	.15	
Triton R-100	lb.	.12 /	.25
X-100, -102, -114	lb.	.255 /	.36
Dispersions			
AgeRite Alba	lb.	3.00	
Powder, Resin D	lb.	.80	
White	lb.	1.80	
Altax	lb.	.75	
Black No. 25	lb.	.22	
Shield Nos. 2, 6	lb.	.08	
3	lb.	.095	
4-35	lb.	.09	
5	lb.	.093	
7-F, 8	lb.	.165	
55	lb.	.18	
Iron Oxide, 60%	lb.	.40	
L.S.W.	lb.	1.50	
No. 305 Liquizinc	lb.	.30 /	.35
P-33	lb.	.35	
Rayox	lb.	.45	
Rotax	lb.	.75	
Sulfur	lb.	.12 /	.30
No. 2	lb.	.14 /	.16
Telloy	lb.	3.00	
Tuads, Methyl	lb.	1.60	
Vulcanizing, C group	lb.	.40 /	1.30
G group	lb.	.45 /	.90
N group	lb.	.40 /	1.00
Zetax	lb.	.75	
Zimates, Butyl	lb.	1.30	
Ethyl, Methyl	lb.	1.35	
Zinc oxide	lb.	.40	
Emulsions			
AgeRite Stalite	lb.	.75	
Habuco Resin Nos. 502, 515, 523	lb.	.195 /	.20
503	lb.	.22 /	.225
504, 526	lb.	.19 /	.195
517	lb.	.175 /	.18
524	lb.	.155 /	.16
Resin A-2	lb.	.16 /	.25
P-370	lb.	.175 /	.25
X-210	lb.	.12 /	.22
Freeze-Stabilizer 322	lb.	.40	
12116C	lb.	.52	
Gelling Agent P-397	lb.	.34 /	
Igepon T-43	lb.	.145 /	.35
T-51	lb.	.125 /	.285
-73	lb.	.285 /	.495
Indulins	lb.	.06 /	.08
Ludox	lb.	.1675/	.195
Marmix	lb.	.41 /	.48
Merac	lb.	.75 /	1.05
Micronex, colloidal	lb.	.06 /	.072
Monsanto Blue 4685 WD	lb.	1.60	
Green 4884 WD	lb.	1.80	
Red 127	lb.	1.25	
OPD-101	lb.	.16 /	.26
Pliolite Latex 150, 190	lb.	.32 /	.41
170	lb.	.37 /	.46
Polyvinyl methyl ether	lb.	.25 /	.45
Resin V	lb.	.13	
Roelgel 100C	lb.	.46	
Santomerse D	lb.	.44 /	.65
S	lb.	.13 /	.25
Sellogen Gel	lb.	.1275	
Sequestrene AA	lb.	.905 /	.975
30A	lb.	.245 /	.265
ST	lb.	.585 /	.615
Setsit #5	lb.	.75 /	1.05
Stablex A	lb.	.80 /	1.10
B, G	lb.	.50 /	.95
K	lb.	.27 /	.35
P	lb.	.35 /	.50
T	lb.	.14 /	.22
Surfactol 13	lb.	.345 /	.36
Webnix	lb.	1.50 /	2.50

Mold Lubricants

Acintol D	lb.	.06 /	.075
A-C Polyethylene	lb.	.30 /	.37
Akro Gel	lb.	.165	
Alipal CO-433	lb.	.25 /	.45
CO-436	lb.	.22 /	.41
Aquarex Compounds	lb.	.21 /	.94
Carbowax 200, 300, 400	lb.	.22 /	.25
1500	lb.	.255 /	.2825
4000	lb.	.31 /	.32
6000	lb.	.35 /	.36
Castorwax	lb.	.21 /	.27
Colite Concentrate	gal.	.90 /	1.15
D-Tak Dip #10	gal.	1.50	
ELA	lb.	.82	
DC Mold Release Fluid Emulsion Nos. 35, 35A, 35B, 36	lb.	3.39 /	4.75
DC7	lb.	1.36 /	2.50
8	lb.	5.13 /	6.50
Glycerized Liquid Lubricant, concentrated	gal.	1.36 /	1.80
Igepals	lb.	1.48 /	1.63
Igepon AP-78	lb.	.2875/	.74
T-43	lb.	.44 /	.68
T-51	lb.	.145 /	.35
T-73	lb.	.125 /	.285
Lubrex	lb.	.285 /	.495
Lubri-Flo	gal.	.25 /	.30
Lustermold	lb.	$10.00 /	$12.05
Mold Paste	lb.	.41	
Monopole Oil	lb.	.25	
Monten Wax	lb.	.16	
Para Lube	lb.	.57	
Pluronics	lb.	.046 /	.048
Polyglycol E series	lb.	.335 /	.44
Rubber-Glo	gal.	.29 /	.42
Soap, Hawkeye	lb.	.94 /	.97
Purity	lb.	1.35 /	1.45
Sodium stearate	lb.	.155 /	.165
Stoner's 700 series	gal.	.40	
800 series	gal.	1.20 /	1.25
900 series	gal.	1.26 /	1.70
A Series	gal.	1.55 /	2.55
Ucon 50-HB Series	lb.	1.80 /	4.50
Ulco	lb.	.25 /	.375
Vanfre	gal.	.12 /	.23
		2.50 /	3.00

Odorants

Alamasks	lb.	.75 /	6.50
Coumarin	lb.	2.95 /	3.55
Curodex 19	lb.	4.75 /	5.05
188	lb.	5.75	
198	lb.	6.75	
Ethavan	lb.	6.75 /	7.35
Latex Perfume #7	lb.	4.00	
Neutroleum Gamma	lb.	3.60	
Rubber Perfume #10	lb.	2.60	
Vanillin, Monsanto	lb.	3.00 /	3.15

Plasticizers and Softeners

Acintol R	lb.	.065 /	.07
Adipol 2EH, 10A	lb.	.425 /	.455
BCA	lb.	.45 /	.475
ODY	lb.	.47 /	.50
Admex 710	lb.	.325	
711	lb.	.345	
744	lb.	.40	
Aro Lene #1980	lb.	.10 /	.12
Baker AA Oil	lb.	.195 /	.24
Crystal O Oil	lb.	.21 /	.255
Processed oils	lb.	.215 /	.235
Bardol, 639	lb.	.215 /	.235
B	lb.	.0625/	.065
Benzoflex 2-45	lb.	.26 /	.29
9-88	lb.	.27 /	.30
Bondogen	lb.	.55 /	.60
BRC 20	lb.	.15 /	.175
22	lb.	.025 /	.0275
30	lb.	.0125/	.021
521	lb.	.019 /	.02
BRH 2	lb.	.0213/	.0351
BRS 700	lb.	.02 /	.0285
BRT 7	lb.	.03 /	.031
BRV	lb.	.0475/	.0565
Bunarex Liquid	lb.	.0425/	.0555
Resins	lb.	.065 /	.1225
Bunnatol G, S	lb.	.40 /	.505
Butac	lb.	.125 /	.135
Butyl stearate, comml.	lb.	.24 /	.27
Binney & Smith	lb.	.23 /	.26
Hardesty	lb.	.23 /	.26
Ohio-Apex	lb.	.22 /	.25
BxDC	lb.	.40 /	.41
Cabflex HS-10	lb.	.44 /	.47
Califlux 510, 550	lb.	.025 /	.0325
G, P	lb.	.0125/	.02
R-100	lb.	.045 /	.0525
TT	lb.	.017 /	.0245
Capryl alcohol, comml.	lb.	.195 /	.235
Binney & Smith	lb.	.18 /	.28
Hardesty	lb.	.18 /	.28
Chlorowax 40	lb.	.145 /	.225
70	lb.	.18 /	.24
-S	lb.	.21 /	.27
Contogums	lb.	.0875/	.111
Cumar Resins	lb.	.065 /	.17
DBM (dibutyl-m-cresol)			
Darex	lb.	.32 /	.3475
DBP (dibutyl phthalate), comml.	lb.	.30 /	.33
Darex	lb.	.30 /	.33
Hatco	lb.	.30 /	.33
Monsanto	lb.	.30 /	.33
Naugatuck	lb.	.30 /	.33
Ohio-Apex	lb.	.30 /	.33
PX-104	lb.	.30 /	.33
Rubber Corp. of America	lb.	.30 /	.44
Sherwin-Williams	lb.	.30 /	.33
DBS (dibutylsebacate), comml.	lb.	.66 /	
Hatco	lb.	.66 /	85
Monoplex	lb.	.66 /	.675
Naugatuck	lb.	.665 /	.69
PX-404	lb.	.665 /	.69
DCP (dicaprylphthalate), comml.	lb.	.295 /	.325
Hatco	lb.	.295 /	.325
Monoplex	lb.	.30 /	.315
DDA (didecyladipate)			
Cabflex	lb.	.425 /	.455
Good-rite GP-236	lb.	.425 /	.57
DDP (didecylphthalate)			
Cabflex	lb.	.305 /	.335
Good-rite GP-266	lb.	.305 /	.455
Hatco	lb.	.305 /	.435
Defoamer X-3	lb.	.355	
DIBA (diisobutyladipate)			
Cabflex	lb.	.4325/	.4625
Darex	lb.	.4325/	.4625
Ohio-Apex	lb.	.4325/	.4625
DIDA (diisodecyladipate)			
Monsanto	lb.	.425 /	.455
DIDP (diisodecylphthalate)			
Darex	lb.	.32 /	.35
Monsanto	lb.	.305 /	.335
Ohio-Apex	lb.	.305 /	.335
PX-120	lb.	.305 /	.335

MACHINERY AND SUPPLIES FOR SALE (Continued)

FOR SALE: DOUBLE-ARM SIGMA-BLADE JACKETED mixers; (4) Read 50 gal., 30 HP; (2) W & P 100-gal. Kux model 25 rotary pellet presses, 21 and 25 punch. 14,000-gal. A. O. Smith Glass-Lined Tanks. WE BUY SURPLUS EQUIPMENT. PERRY EQUIPMENT CORP., 1424 N. 6th St., Phila. 22, Pa.

FOR SALE: 1—STEWART BOLLING 4-ROLL 58" CALENDER; 3—#28 Devine vacuum shelf dryers, 19-59" x 78" shelves, complete; 1—Royle #3 extruder, motor driven; 2—Farrel-Birmingham 16" x 42" mills with reduction drive and 100-HP motor; 1—Ball & Jewell rotary cutter, size 0, m.d.; 1—6" x 12" laboratory mill, m.d.; 1—Read 2,000-lb. all-steel double-ribbon horizontal mixer; 3—Colton #5¼ single-punch tablet machines, m.d.; also other sizes Hydraulic Presses, Tubers, Banbury Mixers, Mills, Vulcanizers, Calenders, Pellet Presses, Cutters. WANTED: Your Surplus Rubber Machinery. CONSOLIDATED PRODUCTS COMPANY, INC., 64 Bloomfield St., Hoboken, N. J.; HOboken 3-4425; N. Y. Phone: BArclay 7-0600.

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Dielex B	lb.	$0.06
Diethylene glycol, comml	lb.	.1525/ $0.1825
Wyandotte	lb.	.15 / .165
Dinopol IDO	lb.	.305 / .335
DIOA (diisooctyladipate)		
Cabflex	lb.	.425 / .455
Naugatuck	lb.	.435 / .465
PX-208	lb.	.425 / .455
Rubber Corp. of America	lb.	.425 / .56
DIOP (diisooctylphthalate), comml	lb.	.305 / .335
Cabflex	lb.	.305 / .335
Darex	lb.	.32 / .35
Hatco	lb.	.305 / .335
Monsanto	lb.	.305 / .335
Naugatuck	lb.	.305 / .335
Ohio-Apex	lb.	.305 / .335
PX-108	lb.	.305 / .335
Rubber Corp. of America	lb.	.305 / .45
Sherwin-Williams	lb.	.32 / .34
DIOS (diisooctylsebacate), comml	lb.	.61 / .64
Rubber Corp. of America	lb.	.61 / .84
DIOZ (diisooctylazelate)		
Cabflex	lb.	.48 / .5075
Dipolymer Oil	gal.	.33 / .38
Dispersing Oil No. 10	lb.	.06 / 0625
DNODP (di-n-octyl-n-decyl phthalate), Monsanto	lb.	.345 / .375
DOA (dioctyladipate), comml	lb.	.425 / .455
Cabflex	lb.	.425 / .455
Good-rite GP-233	lb.	.425 / .57
Hatco	lb.	.435 / .465
Monsanto	lb.	.425 / .455
Naugatuck	lb.	.435 / .465
PX-238	lb.	.425 / .455
Rubber Corp. of America	lb.	.425 / .56
DOP (dioctylphthalate), comml	lb.	.305 / .335
Cabflex	lb.	.305 / .335
Darex	lb.	.32 / .35
Good-rite GP-261	lb.	.305 / .455
Hatco	lb.	.305 / .335
Monsanto	lb.	.305 / .335
Naugatuck	lb.	.305 / .335
Ohio-Apex	lb.	.305 / .335
PX-138	lb.	.305 / .335
Rubber Corp. of America	lb.	.305 / .45
Sherwin-Williams	lb.	.32 / .34
DOS (dioctylsebacate), comml	lb.	.61 / .64
Hatco	lb.	.61 / .635
Monoplex	lb.	.61 / .635
Naugatuck	lb.	.615 / .64
PX-438	lb.	.615 / .64
Rubber Corp. of America	lb.	.61 / .84
Drapex 3.2	lb.	.40 / .45
Dutch Boy NL-A10 (DBP)	lb.	.30 / .33
-A20 (DOP), A30 (DIOP)	lb.	.305 / .335
-A54	lb.	.295 / .325
-C20 (DOS)	lb.	.61 / .63
-F21	lb.	.395 / .425
-F31	lb.	.44 / .47
-F41	lb.	.48 / .51
Dutrex 6	lb.	.025 / .035
Emulphor EL-719	lb.	.52 / .73
Ethox	lb.	.43 / .455
Ethylene glycol, comml	lb.	.135 / .165
Wyandotte	lb.	.1325/ .1425
Flexol 3 GH	lb.	.44 / .46
3 GO	lb.	.53 / .55
4 GO	lb.	.325 / .355
426	lb.	.27 / .30
810, 810X, 10-10, 10-10X	lb.	.305 / .335
TOF, A-26	lb.	.435 / .465
Flexricin P-1	lb.	.295 / .31
P-4	lb.	.285 / .30
P-8	lb.	.305 / .32
PG-16	lb.	.335 / .35
Fortex	lb.	.125 / .145
G. B. Asphaltic Flux	gal.	.08 / .14
Naphthenic Neutrals	gal.	.11 / .18
Process oil, light	lb.	.025 / .0325
Medium	lb.	.035 / .0425
Galex W-100	lb.	.155 / .18
W-100 D	lb.	.1525/ .1775
Gilsowax B	lb.	.0975/ .11
Harchemex	lb.	.25 / .34
Harflex 10	lb.	1.25 / 1.335
40	lb.	.66 / .745
50, 80	lb.	.61 / .695
60	lb.	.62 / .705
90	lb.	.88 / .965
120, 150	lb.	.32 / .35
140, 160, 180	lb.	.30 / .33
220	lb.	.435 / .465
260	lb.	.42 / .45
280	lb.	.43 / .46
500	lb.	.315 / .345
HB-20	lb.	.15 / .17
-40	lb.	.19 / .21
Heavy Resin Oil	lb.	.0225/ .0375
HSC-13	lb.	.27 / .30
Indoil Compound 51-S	lb.	1.00 / 1.10
Indonex	gal.	.11 / .19
Kapsol	lb.	.3225/ .3525
Kenflex A, L	lb.	.26 / .27
B	lb.	.23 / .24
N	lb.	.18 / .19
Kessoflex 103	lb.	.405
105	lb.	.3325
106	lb.	.38
107	lb.	.525
110	lb.	.24
111	lb.	.28
KP-23	lb.	.29 / .32
-90	lb.	.40 / .43
-140	lb.	.46 / .485
KP-201	lb.	$0.5825/ $0.5925
-220	lb.	.31 / .34
-555	lb.	.45 / .475
Kronisol	lb.	.33 / .355
Kronitex AA, I	lb.	.33 / .36
Marvinol plasticizers	lb.	.28 / .8825
Methox	lb.	.385 / .41
Monoplex S-38	lb.	.215 / .24
S-71	lb.	.45 / .475
Morflex	lb.	.25 / .65
Neoprene Peptizer P.-12	lb.	1.05
Nevillac	lb.	.39 / .85
Neville R Resins	lb.	.15 / .35
Nevinol	lb.	.20
No. 1-D heavy oil	lb.	.065
ODA (octyldecyladipate) Cabflex	lb.	.425 / .455
Good-rite GP-235	lb.	.425 / .57
ODP (octyldecylphthalate) Cabflex	lb.	.305 / .335
Good-rite GP-265	lb.	.305 / .455
Hatco	lb.	.305 / .335
Rubber Corp. of America	lb.	.305 / .45
Ohopex R-9	lb.	.3525/ .3775
Q-10	lb.	.295 / .325
Orthonitro benzophenol, comml	lb.	.13 / .15
Monsanto	lb.	.13 / .15
Palmalene	lb.	.15
Panaflex BN-1	lb.	.185 / .225
Para Flux, regular	gal.	.10 / .2125
No. 2016	gal.	.165 / .24
2332	gal.	.11
4205	lb.	.1075/ .2125
Para Lube	lb.	.046 / .048
Resins	lb.	.04 / .045
Paradene Resins	lb.	.065 / .075
Paraplex 5-B	lb.	.29 / .3475
AL-111	lb.	.32 / .3275
G-25	lb.	.79 / .80
-40	lb.	.51 / .52
-50	lb.	.4025/ .4275
-53	lb.	.45 / .475
-60	lb.	.325 / .35
-62	lb.	.345 / .37
RG-7	lb.	.33 / .335
-8	lb.	.505 / .5125
-10	lb.	.52 / .5275
Pepton 22	lb.	.79 / .82
Philrich 5	gal.	.11
Picco Resins	lb.	.135 / .195
480 Oilproof Series	lb.	.18 / .23
Aromatic Plasticizers	lb.	.05 / .065
Liquid Resin D-165 (Y)	lb.	.06 / .075
(Z-3)	lb.	.07 / .085
(Z-6)	lb.	.08 / .095
S. O. S.	gal.	.29 / .34
Piccocizers	lb.	.04 / .055
Piccolastic Resins	lb.	.1855/ .34
Piccolyte Resins	lb.	.185 / .25
Piccopale Resins	lb.	.12 / .135
Piccovars	lb.	.165 / .20
Piccovol	lb.	.025 / .038
Pictar	gal.	.25 / .30
Pigmentar	lb.	.0427/ .0712
Pigmentaroil	lb.	.0427/ .0712
Pine Tar, American	lb.	.0438/ .0712
Sunny South	lb.	.0427/ .0712
Oil, American	lb.	.0438/ .0712
Sunny South	lb.	.0427/ .0712
Pitch, Burgundy, Sunny South	lb.	.1005/ .106
Plasticizers 42	lb.	.34 / .40
B	lb.	.35 / .45
DP-520	lb.	.435 / .455
MP	lb.	.035 / .0755
MT-511	lb.	.535 / .565
ODN	lb.	.32 / .37
SC	lb.	.54 / .63
Plastoflex #3	lb.	.52 / .57
#520	lb.	.36 / .435
DBE	lb.	.50 / .55
MGB	lb.	.32 / .40
SP-2	lb.	.43 / .48
VS	lb.	.40 / .475
Plastogen	lb.	.0775/ .08
Plastone	lb.	.22 / .3075
Polycin 470	lb.	.275 / .29
Polycizers	lb.	.40 / .47
Polymel D	lb.	.225 / .235
DX, C-130	lb.	.1375/ .1475
C-128	lb.	.1775/ .1875
D-TAC	lb.	.1975/ .215
PT67 Light Pine Oil	gal.	.60
101 Pine Tar Oil	lb.	.0427/ .0601
Pine Tars	lb.	.0427/ .0601
R-19, R-21 Resins	lb.	.1075
Reogen	lb.	.1325/ .135
Resin C pitch	lb.	.0225/ .031
R6-3	lb.	.38 / .40
Resinex 10, 25, 50, 110	lb.	.04 / .045
70	lb.	.0325/ .0375
85, 100	lb.	.035 / .04
115	lb.	.0375/ .0425
L-2, L-3, L-4, L-5	lb.	.0225/ .03
Rosin Oil, Sunny South	gal.	.58 / .875
RPA No. 2	lb.	.78
3	lb.	.47
Conc.	lb.	.97
5	lb.	.59
RSN Flux	gal.	.10 / .19
Rubber Oil B-5	lb.	.0225/ .0355
Rubberol	lb.	.2575/ .2725
Santicizer 1-H	lb.	.50 / .51
3	lb.	.46 / .47
8	lb.	.43 / .44
9	lb.	.39 / .42
140	lb.	.33 / .36
Santicizer-141	lb.	$0.34 / $0.37
160	lb.	.25 / .28
601	lb.	.325
602	lb.	.305
B-16	lb.	.4875/ .4975
E-15	lb.	.5075/ .5375
M-17	lb.	.4275/ .4575
Sebacic acid, purified, comml	lb.	.59 / .65
Binney & Smith	lb.	.64 / .76
Hardesty	lb.	.64 / .76
C.P.-Binney & Smith	lb.	.72 / .84
Hardesty	lb.	.72 / .84
Sherolatum Petrolatum	lb.	.05 / .10
Softener #20	gal.	.10 / .20
Special Rubber Resin 100	lb.	.1675/ .2175
Staflex AX	lb.	.43
DBES	lb.	.61 / .635
Syn-Tac	gal.	.33 / .35
Synthol	lb.	.2475
Thiokol TP-90B	lb.	.59
-95	lb.	.65
Tricresyl phosphate, comml	lb.	.33 / .36
Cabflex	lb.	.33 / .36
Monsanto	lb.	.33 / .36
Naugatuck	lb.	.33 / .36
PX-917	lb.	.33 / .36
Triphenyl phosphate, comml	lb.	.39 / .40
Monsanto	lb.	.39 / .40
Turgum S	lb.	.1075/ .1175
Tysonite	lb.	.24 / .2475
United	gal.	.69 / 1.20
X-1 Resinous Oil	lb.	.021 / .0275

Reclaiming Oils

Acintol C, P	lb.	.02 / .03
Bardol, 639	lb.	.0275/ .0375
B	lb.	.0625/ .065
BRH 2	lb.	.0213/ .0351
BRT 3	lb.	.018 / .0265
4	lb.	.025 / .026
7	lb.	.03 / .031
BRV	lb.	.0475/ .0565
Burco-RA	lb.	.053 / .0805
BWH-1	lb.	.16 / .18
Dipolymer Oil	gal.	.33 / .43
Dispersing Oil No. 10	lb.	.06 / .0625
G. B. Oils	gal.	.10 / .24
Heavy Resin Oil	lb.	.0225/ .0375
LX-777	gal.	.23 / .33
No. 3186	gal.	.28 / .295
Picco 6535	gal.	.25 / .30
C-33	gal.	.215 / .315
-42	gal.	.23 / .33
D-4	gal.	.27 / .37
E-5	gal.	.25 / .35
Q-Oil	gal.	.286 / .36
PT 67	gal.	.60
101 Pine Tar Oil	lb.	.0427/ .0610
150 Pine Solvent	gal.	.44
Reclaiming Oil #3186	gal.	.28 / .385
-G	gal.	.25 / .365
4039-M	gal.	.3275/ .3975
-Y	gal.	.30 / .37
RR-10	lb.	.36
S. R. O.	lb.	.015 / .0225
X-1 Resinous Oil	lb.	.021 / .03

Reinforcers, Other Than Carbon Black

American Resinous Chemical 978-42B	lb.	.18 / .19
1073-18B	lb.	.135 / .145
1294-36B	lb.	.115 / .125
1301-12B	lb.	.15 / .16
Angelo Shellacs	lb.	.485 / .7325
BRC 20	lb.	.15 / .175
22	lb.	.025 / .0275
30	lb.	.0125/ .021
521	lb.	.019 / .02
Bunarex Resins	lb.	.065 / .1225
Cab-o-sil	lb.	.68 / .75
Calcene NC	ton	72.50 / 92.50
TM	ton	75.00 / 95.00
Calco S. A	lb.	.85 / .88
Clays		
Aiken	ton	14.00
Buca	ton	45.00
Burgess HC-75	ton	12.00 / 30.00
HC-80	ton	14.00 / 32.00
Iceberg	ton	50.00 / 60.00
Pigment No. 20	ton	35.00 / 60.00
30	ton	37.00 / 60.00
Catalpo	ton	35.00
Crown	ton	14.00 / 33.00
Dixie	ton	14.00
Franklin	ton	13.50 / 35.25
L. G. B.	ton	17.00
Paragon	ton	13.50 / 33.00
Pigment No. 33	ton	37.00
Recco	ton	14.00
Suprex	ton	14.00 / 33.50
Swanee	ton	12.50
Whitetex	ton	50.00
Windsor	ton	14.00 / 30.00
Witco No. 1	ton	14.00 / 30.00
No. 2	ton	13.50 / 30.00
Clearcarb	lb.	.1175/ .1255
Cumar Resins	lb.	.065 / .17
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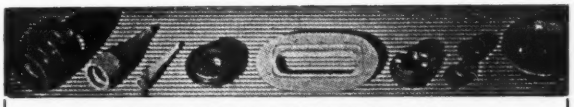

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R	lb.	.13 /	.18
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Picco Resins	lb.	.13 /	.185
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Witcarb R	ton	105.00 /	120.00
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Zeolex 23	ton	120.00 /	140.00
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Good-rite Vultrol	lb.	.62 /	.66
R-17 Resin	lb.	.1075/	.36
Retarder ASA	lb.	.57	
J	lb.	.62 /	.64
PD	lb.	.35 /	.37
W	lb.	.45	
Retardex	lb.	.47 /	.50
Thionex	lb.	1.14	

Solvents

Bondogen	lb.	.55 /	.60
Butyrolactone	lb.	$0.60 /	$0.65
Cosol #1	gal.	.37 /	.43
#2	gal.	.42 /	.48
Dichloro Pentanes	lb.	.04 /	.07
Dipentene DD	gal.	.30 /	.57
Ethylene dichloride, comml.	lb.	.09 /	.1225
Hi-Flash 2-50-W	gal.	.41	
Pale yellow	gal.	.39	
LX-572	gal.	.27 /	.32
-748	gal.	.16 /	.23
n-Methyl-2-pyrrolidone	lb.	.75 /	.80
Neville Nos. 100, 104	gal.	.52 /	.60
106	gal.	.38 /	.46
Nevsol B	gal.	.20 /	.30
H, 200	gal.	.19 /	.29
HF, T, 30	gal.	.24 /	.34
Penetrell	gal.	.30 /	.57
Picco Hi-Solv Solvents	gal.	.16 /	.48
Pine Oil DD	lb.	.1125/	.1325
PT 150 Pine Solvent	gal.	.44	
Skellysolve-E	gal.	.153	
-H	gal.	.133	
-R, -V	gal.	.109	
-S	gal.	.099	
Stauffer Carbon Disulphide	lb.	.0525/	.085
Tetrachloride	lb.	.0825/	.475

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RG	lb.	.17
Vinyltoluene	lb.	.17
Rohm & Haas ethyl acrylate	lb.	.34
Methyl acrylate	lb.	.37

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DDM	lb.	.85 /	.88
Thiostop K	lb.	.53	
N	lb.	.41	

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A25, A26, 716-30	lb.	.18 /	.19
555-40R	lb.	.185 /	.205
620-32B	lb.	.20 /	.21
716-35	lb.	.17 /	.18
1041-21	lb.	.165 /	.175
Acintol R	lb.	.065 /	.07
Bardol, 639	lb.	.0275/	.0375
BRH 2	lb.	$0.0213/	$0.0351
Bunatex Resins	lb.	.065 /	.1225
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Contogums	lb.	.0875/	.11
Cumar Resins	lb.	.065 /	.17
Galex W-100	lb.	.155 /	.17
W-100D	lb.	.1525 /	.1625
Indopol H-35	gal.	.65 /	.81
H-50	gal.	.70 /	.86
-100	gal.	.85 /	1.05
-300	gal.	1.00 /	1.21
L-10	gal.	.40 /	.56
-50	gal.	.45 /	.61
-100	gal.	.55 /	.71
Kenflex resins	lb.	.18 /	.27
Koresin	lb.	.90 /	1.10
Natac	lb.	.12 /	.13
Nevindene	lb.	.15 /	.18
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Piccolastic Resins	lb.	.1855 /	.34
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Synthol	lb.	.2475 /	.2625
United	gal.	.69 /	1.20

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G-M-F #113, #117	lb.	.90	
Ko-Blend I, S	lb.	.39	
Litherage (*See Accelerator-Activators, Inorganic*)			
Magnesium oxide	lb.	.2525/	.38
Merck, Light Calcined	lb.	.2525/	.26
Extra Light Calcined	lb.	.2925/	.30
Red lead (*See Accelerator-Activators, Inorganic*)			
Sufsal R	lb.	1.50	
Sulfur flour, comml.	100 lbs.	2.30 /	3.05
Aero	100 lbs.	2.15 /	7.50
Crystex	lb.	.195 /	.23
Insoluble 60	lb.	.125 /	.13
Rubbermakers	100 lbs.	2.40 /	4.30
Stauffer	lb.	.024 /	.0515
Telloy	lb.	2.50	
VA-7	lb.	.50 /	.60
Vandex	lb.	6.00	
Vultac No. 2	lb.	.47 /	.755
3	lb.	.51 /	.795
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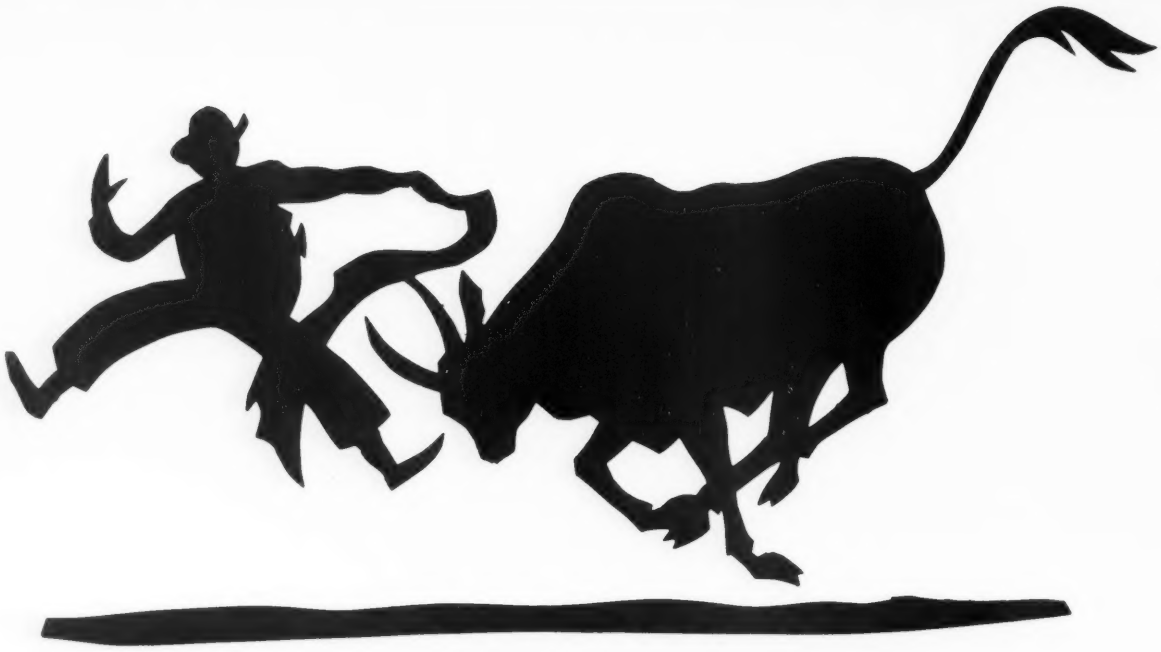

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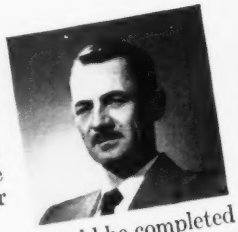

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